ENGINEERING AND MINING JOURNAL

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MAY 1950

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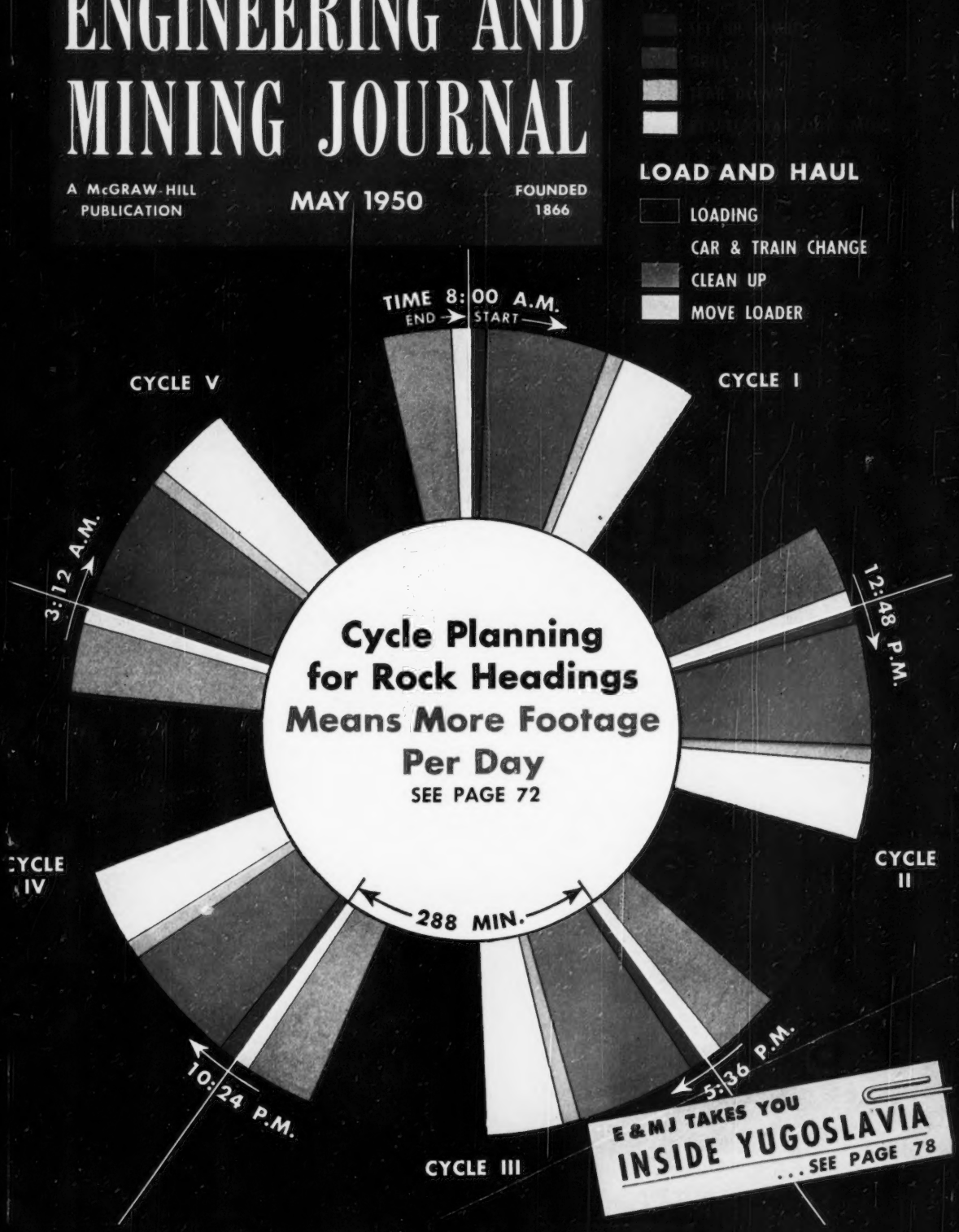

Cycle Planning for Rock Headings Means More Footage Per Day

SEE PAGE 72

E&MJ TAKES YOU INSIDE YUGOSLAVIA

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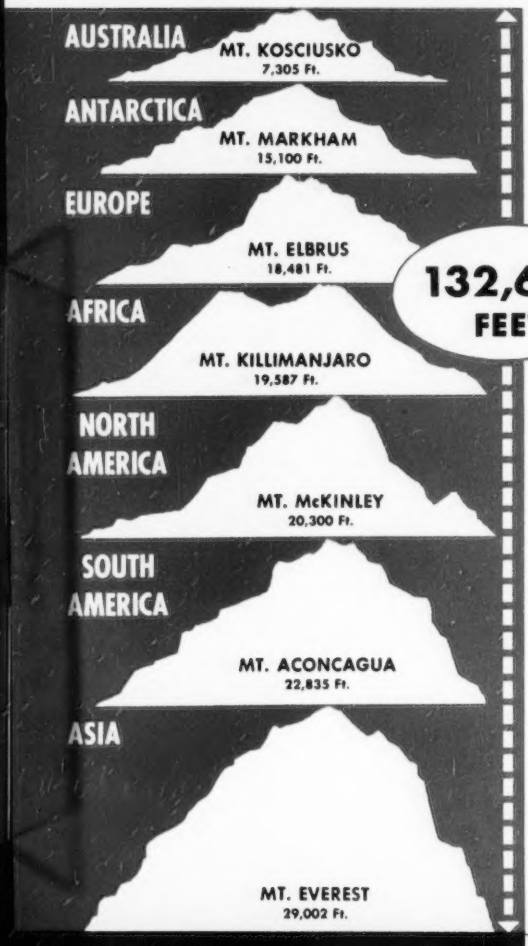
TOTAL HEIGHT OF THE TALLEST MOUNTAINS IN EACH OF SEVEN CONTINENTS



TOTAL OF HEADS DEVELOPED BY HYDROSEAL PUMPS THROUGHOUT THE WORLD

135,000 FEET

Hydroseal pumps are giving "peak" performance and service in every part of the world. These records are made possible because...

1—Hydrosealing prevents abrasive-laden water from entering clearance between the impeller and pump's side-plates—gives efficiency and economy.

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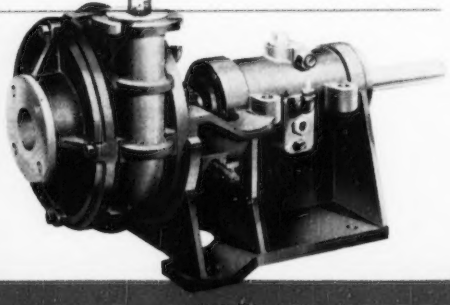
3—Performance-Tested Engineering. We keep complete data on the Hydroseal Pumps in operation, covering almost every conceivable pumping condition. This is the basis for our thorough understanding of *your* problem.

Tell us your pumping problem in detail when you write to us for more information on Hydroseals. We'll be glad to suggest the system that will make your "mountains into molehills."



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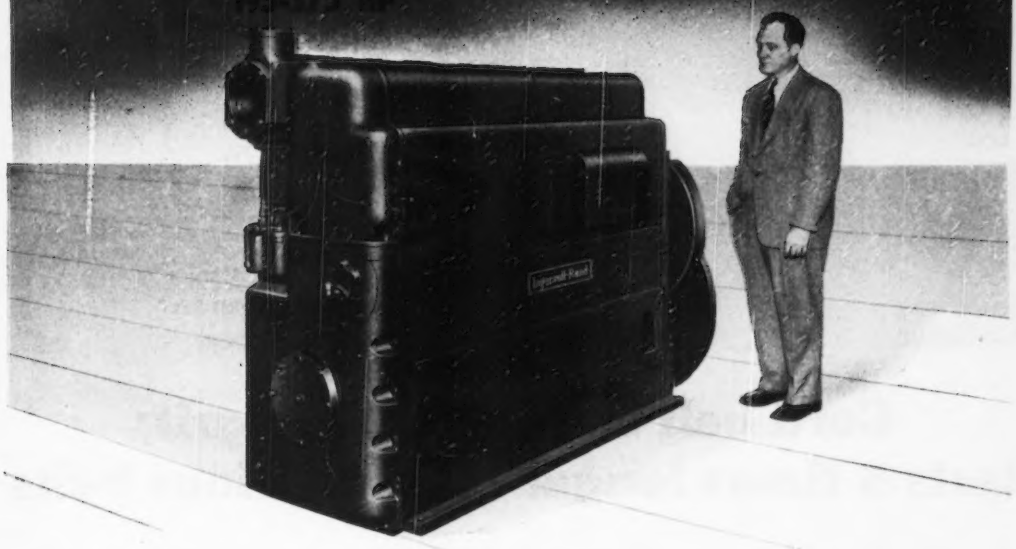
HYDROSEAL PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

A SMALLER, LIGHTER, HEAVY-DUTY DIESEL ENGINE



Here's the heavy-duty Diesel that engineers have been looking for . . . a 4-cycle, single-acting engine that weighs only 30 lbs per hp, and consumes only 0.40 lbs of fuel per hp-hour.

The Ingersoll-Rand TS Diesel is available with 6 or 8 in-line cylinders, delivering 195 to 375 continuous hp at 900 to 1000 rpm. What's more, the new TS Diesel has the extra stamina and dependability of big-engine design. Its 5¼"-diameter crankshaft is extra-large for a 7"-bore engine.

Movable	but NOT Automotive Type
Low Weight	but Moderate Speed
Small Size	but BIG-Engine Design
Powerful	but LOW Exhaust Temperatures
Perfect Balance	but NO Balancing Devices

These results have been achieved by using an improved combustion system with single-hole injection nozzles, a gear-driven supercharger providing additional scavenging air for internal cooling, an increased overlap of exhaust- and intake-valve openings, and a big crankshaft. One of the distinctive low-maintenance and long-life features is its aluminum-alloy full-floating bearings . . . with each half bearing being interchangeable for main and crankpin bearings.

Engineers who have seen the TS Diesel agree that it is the outstanding advance in diesel design in the past decade. Write today for more information on the new TS Diesel . . . or for greater power ask about the well-known S and SS Diesels up to 900 hp.

The New Ingersoll-Rand TS Diesel is ideal for:

Drilling Rigs	Locomotives	Emergency
Shovels	Drag Lines	Generating
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And for any service requiring continuous full-load economical operation.

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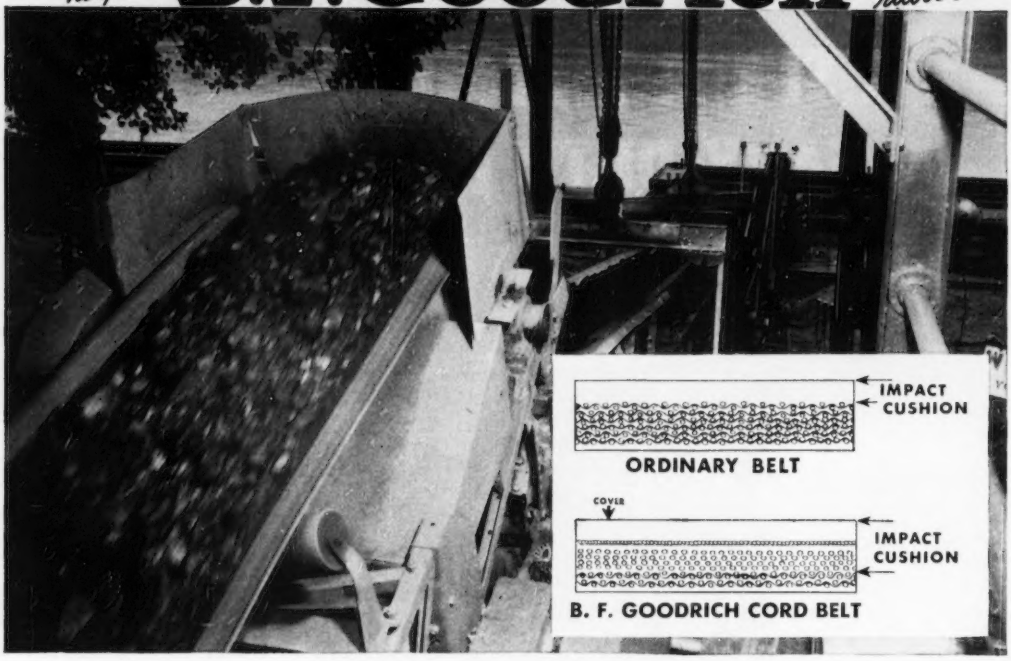

Cord belt stands rushing grit; lasts 5 times longer than previous belts

B. F. Goodrich belt saves 50 man-days of labor in track-to-river installation

THE coal here travels from freight cars to river barges, riding the length of one belt, dropping six feet to the next, and so on down the "staircase". The stream of pulverized coal is constant, speed of the belt is usually 450 feet per minute, carrying about 450 short tons per hour, 500,000 tons a year.

Ordinary belts wore out in a year, sometimes sooner. B. F. Goodrich Cord belts were installed. The oldest is still in service after 5 years, delivering 2,500,000 tons, as against 500,000 for ordinary belts. At least 50 man-days of labor have been saved—time that would have been spent repairing and replacing ordinary belts. Here's why the B. F. Goodrich Cord belts give this kind of service:

Impact Resistance—Each lengthwise cord is completely surrounded and cushioned by rubber; all the rubber forms one connected mass. This rubber-borne cord body has virtually the same impact resistance as the cover itself. Cords are free to "give" when impact occurs. It distorts temporarily, distributing and absorbing a shock that would damage stiff unyielding plies. In addition to the regular cord body, B. F. Goodrich has added a patented *Transcord Breaker*—an *extra* layer of parallel cords in rubber, placed across belt width. Acts as a shock absorber; stretches to prevent gouges and cuts from splitting belt cover. B. F. Goodrich Cord belt has 2 to 6 times the impact resistance of ordinary belts.

Troughing—There being no crossweave in the cord plies, cords are free to flex, conform to idlers, pulleys. No spillage. Troughs naturally even when running empty.

Adhesion—Ply separation in a B. F. Goodrich Cord belt is practically impossible. Rubber-surrounded cords make one integral piece of rubber.

Moisture and Acid Resistance—Cords are twisted tighter than ordinary yarn, not susceptible to moisture. Rubber-surrounded cords keep out air, dampness, prevent mildew.

The first B. F. Goodrich Cord belt ever made is still on the job after 12 years and over 14 million tons of rough-riding coal. If you're looking for similar savings in coal-hauling, call in your local BFG distributor, or write *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Conveyor Belts BY
B.F.Goodrich

ENGINEERING AND MINING JOURNAL

84th YEAR OF PUBLICATION

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When mine car wheels are lubricated with TEXACO OLYMPIAN GREASE

YOU can use *Texaco Olympian Grease* the year around. Its long-lasting, protective lubricating qualities, its low starting and running torque, are not affected by seasonal temperature changes. It *stays in* the bearings in summer, assures easier starts for trains in winter.

Texaco Olympian Grease is made in three consistencies especially for mine car

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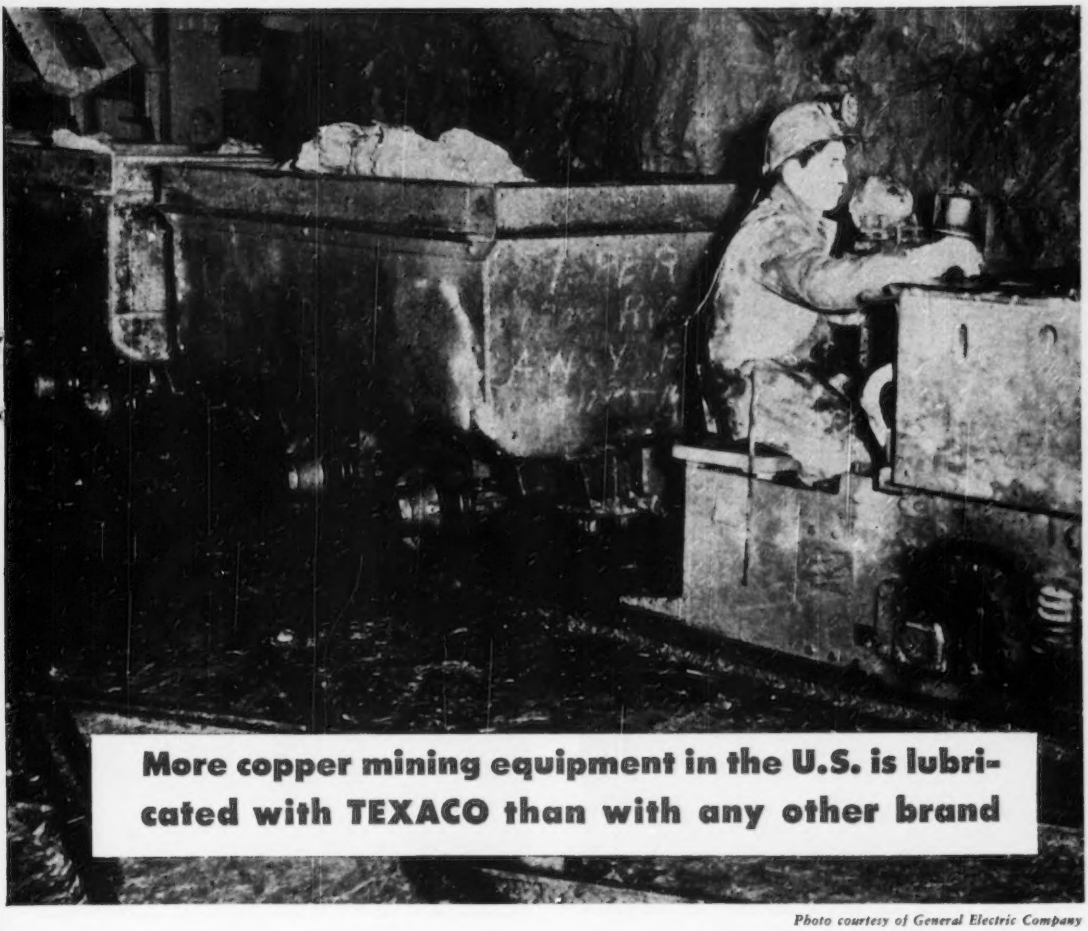

Photo courtesy of General Electric Company

service. It has high resistance to oxidation and will not separate . . . seals out dirt and moisture. This assures greater protection for bearings (plain, cavity hub, or anti-friction) . . . reduces maintenance costs.

To assure longer life for open gears, use *Texaco Crater X Fluid.* It goes on as a fluid, stays on as a tough, clinging film that absorbs heavy loads, reduces wear and noise. To keep wire rope strong longer, lubricate it with *Texaco Crater.*

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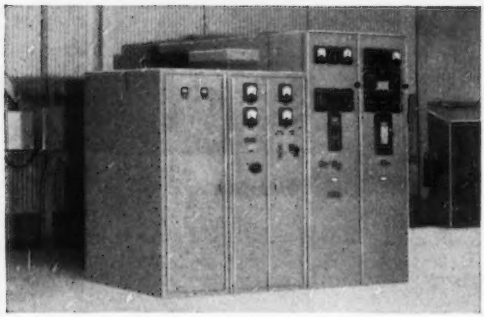
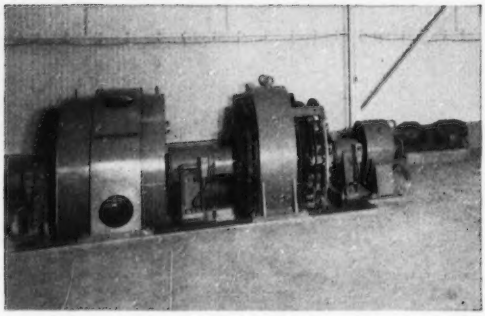
Lubricants and Fuels
FOR THE MINING INDUSTRY

AUTOMATIC HOISTING for continuous tonnage!



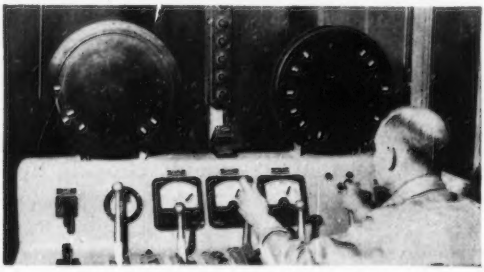
Completely metal-enclosed for personnel safety, this control cubicle houses the synchronous motor switchgear panel, plus Ward Leonard type d-c control equipment. Less space requirement and simplified control result from use of the G-E amplidyne, which eliminates need for many contactors and relays, while permitting the retention of safe limits on the hoist's acceleration and deceleration.



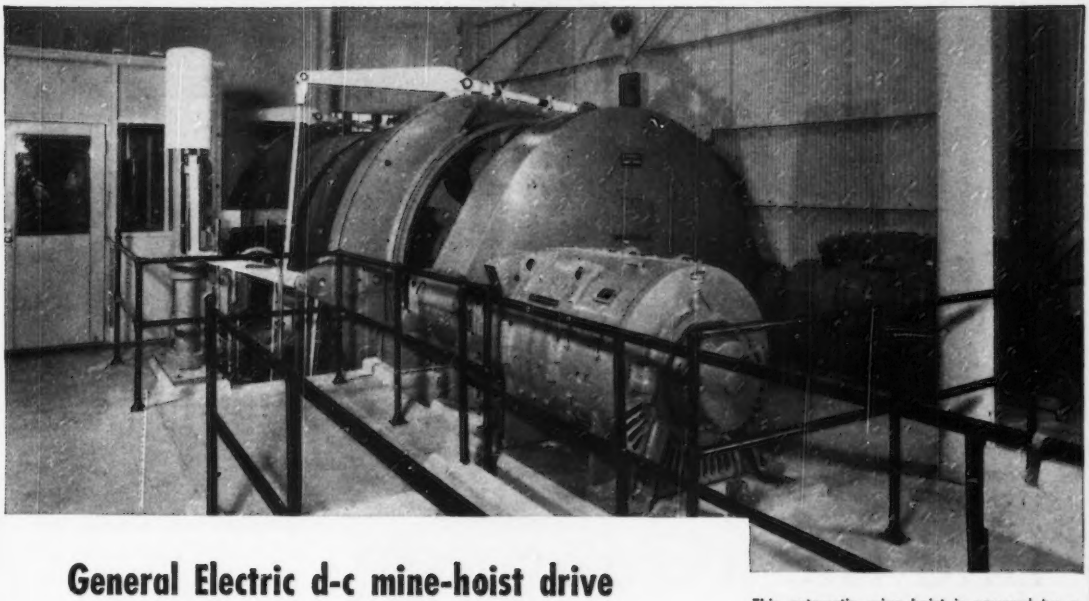
Converting a-c to d-c, this G-E motor-generator set comprises a 750-kw generator, an 1100-hp synchronous motor, and a 20-kw exciter. The generator supplies adjustable-voltage power for the operation of the two hoist motors. At right, the G-E amplidyne, used as an exciter for this generator, provides superior operation and more positive limits of acceleration and deceleration, for greater safety, increased production.

MINE-HOIST DRIVES

—to cut mining costs!



When necessary for inspection, testing, or man-trips, control of the hoist can quickly be switched from automatic to the manually operated master controller as above. Adequate starting, stopping, and maneuvering of the skips with ease, precision, and safety is provided by the optional manual operation. With the normal automatic operation, the duties of the operator may be chiefly of another nature.



This automatic mine hoist is powered by a complete G-E drive that includes two 500-hp d-c motors. When the skip at the shaft bottom is fully loaded, it starts and accelerates to full speed. Near the dumping pocket, it automatically slows down, eases through the dumping horns, and makes a dead stop at the final limit of travel, thus completing the entire cycle automatically.

General Electric d-c mine-hoist drive with amplidyne control permits continuous output at 8 tons per minute, simplifies operation, increases safety, prolongs equipment life!

Here is another General Electric amplidyne-controlled d-c mine hoist drive helping to boost output and cut costs—in this case in a New Mexico potash mine.

This high-speed high-tonnage hoist raises in balance an 8-ton payload every minute up an 1150-foot shaft at speeds up to 1500 fpm. The hoist runs fully automatically throughout the entire shift, and may also be run by push-button control operated by the skip loader at the loading level.

Because it is completely automatic, this continuous, highly efficient operation permits hoisting maximum tonnage per man-hour. Hoist speed is closely maintained in spite of load variations, repetitive operation helps cut costs per ton, and personnel may be freed for other duties. Electric braking provides greater safety and prolongs the life of the hoist mechanism.

Applicable for any type of mining, this installation is further evidence of G-E experience in engineering automatic mine-hoist drives, experience that dates back to 1915. Let a G-E mining specialist put this experience to work on *your* mine-hoist problems. Call him at your nearest G-E office. Meanwhile, send for Bulletin GET-1430. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

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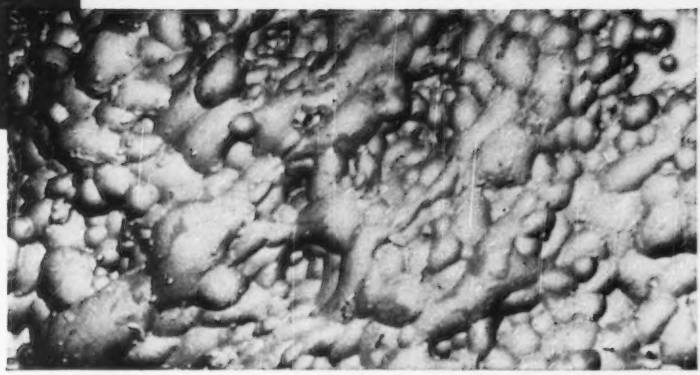

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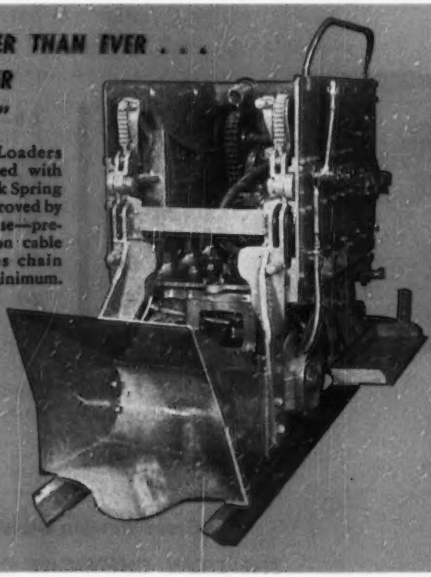
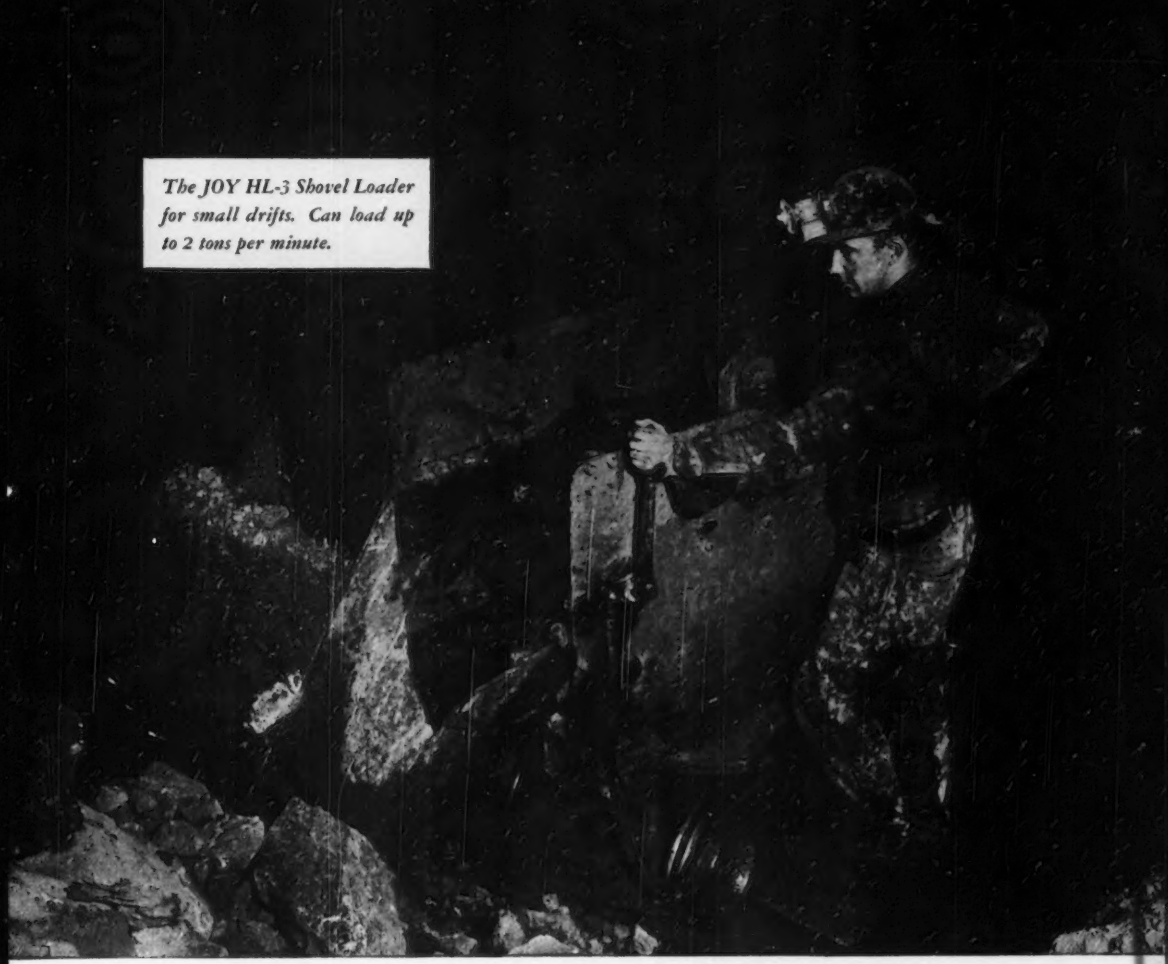
"NOW BETTER THAN EVER . . . WITH LONGER CHAIN LIFE!"

All Joy Shovel Loaders are now equipped with Bucket Kick-Back Spring —a *new* feature proved by months of field use—prevents backlash on cable chains—reduces chain breakage to a minimum.



The JOY HL-20 Shovel Loader for large drifts. Can load up to 3 tons per minute using cars from 50 to 90 cu. feet capacity.



The JOY HL-3 Shovel Loader for small drifts. Can load up to 2 tons per minute.

Note these Superior Features

They mean Lower Maintenance—Faster Loading at Less Cost—Greater Flexibility

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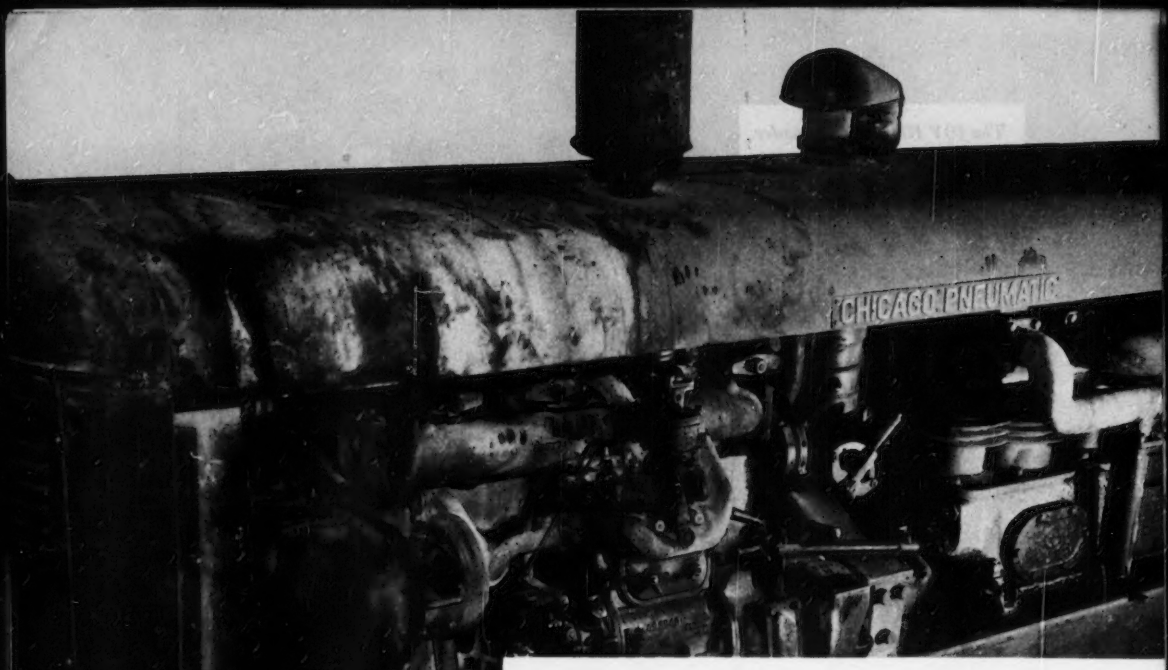

MONEY SAVER in a mine

For dependable and low-cost power, the Ft. Dodge Limestone Co., Ft. Dodge, Iowa, relies on a "Caterpillar" Diesel D8800 Engine. Like other "Cat" Diesels, this D8800 more than earns its keep, working steadily and profitably with a minimum of down time. Its ability to use non-premium fuels without fouling adds to its owner-profit. Powering a Chicago Pneumatic compressor which supplies air for drilling, it is doing a standout job on this 70-ton-an-hour operation.

Every "Caterpillar" Diesel is finely engineered, ruggedly built and precision-tested to assure full horsepower output. That's a fact well worth keeping in mind next time you order mining machinery. By specifying a "Cat" Diesel for air compressors, shovels and other types of mining equipment, you can be sure of getting an engine with horsepower that's *all there*.

Your "Caterpillar" dealer knows engines. He has the parts and facilities for efficient, on-the-spot service. Get in touch with him for further facts about rugged, reliable "Cat" Diesels.

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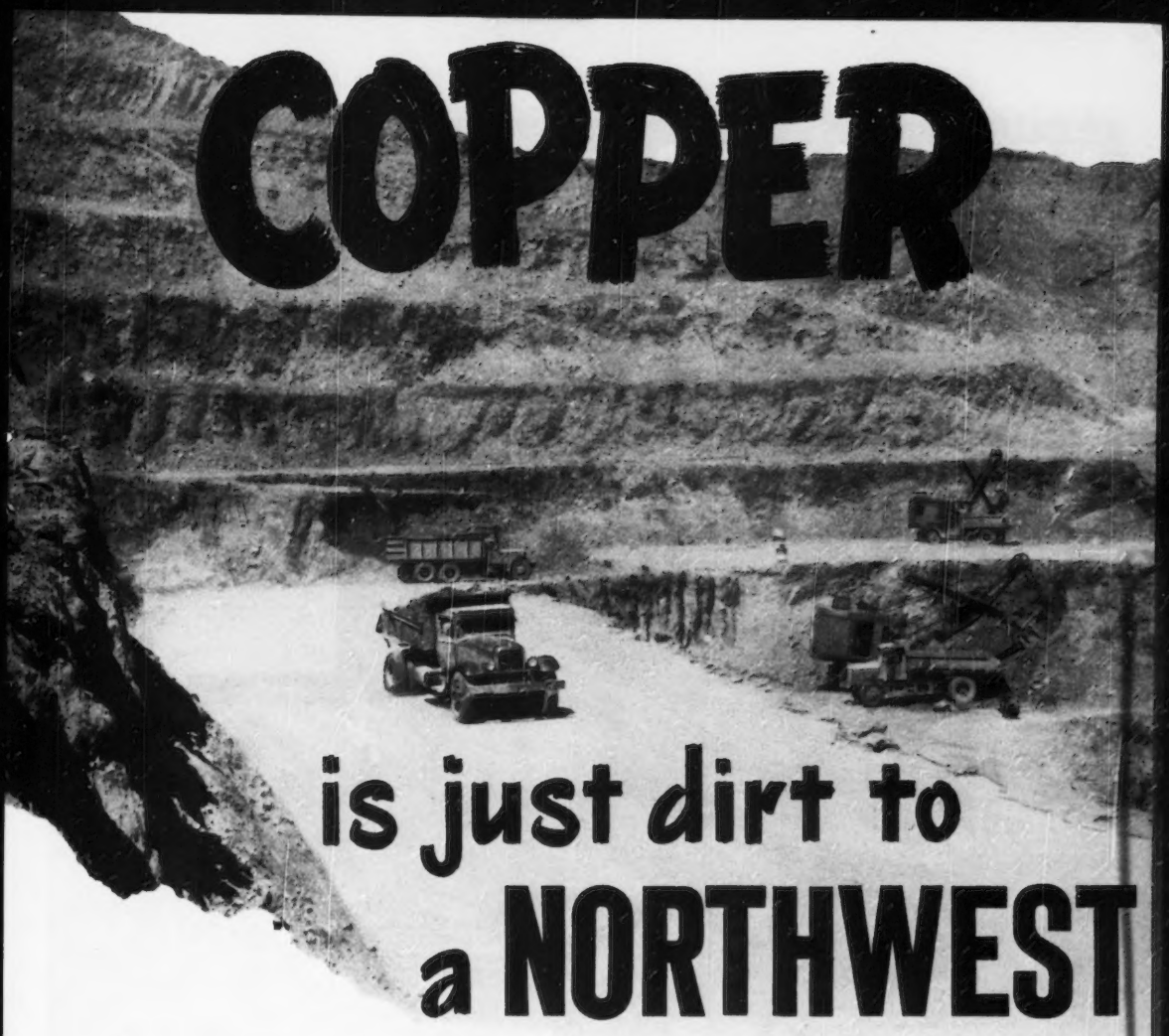
MOTOR GRADERS
EARTHMOVING EQUIPMENT



is just dirt to a NORTHWEST

And, so is every other kind of digging whether it is Rock or Loam. If you have a real Rock Shovel you are assured of output in any digging.

Here are three Northwests in one of the largest copper pits in the world keeping the trucks on the move. They are proving the value of such Northwest advantages as Northwest Positive Traction, the "Feather-Touch" Clutch Control, the Northwest Cushion Clutch, Northwest Dual Independent Crowd and Northwest Simplicity of Design that makes upkeep easy and reduces "down time." These things are proving out in mining and hard rock work.

If you are planning modernization, expansion or additions in your pit you will find that Northwest advantages will speed up your output and cut your pit costs. Why not plan now for a fully Northwest equipped pit? We'd like to tell you more about Northwest Advantages and what Northwests are doing for other mining properties.

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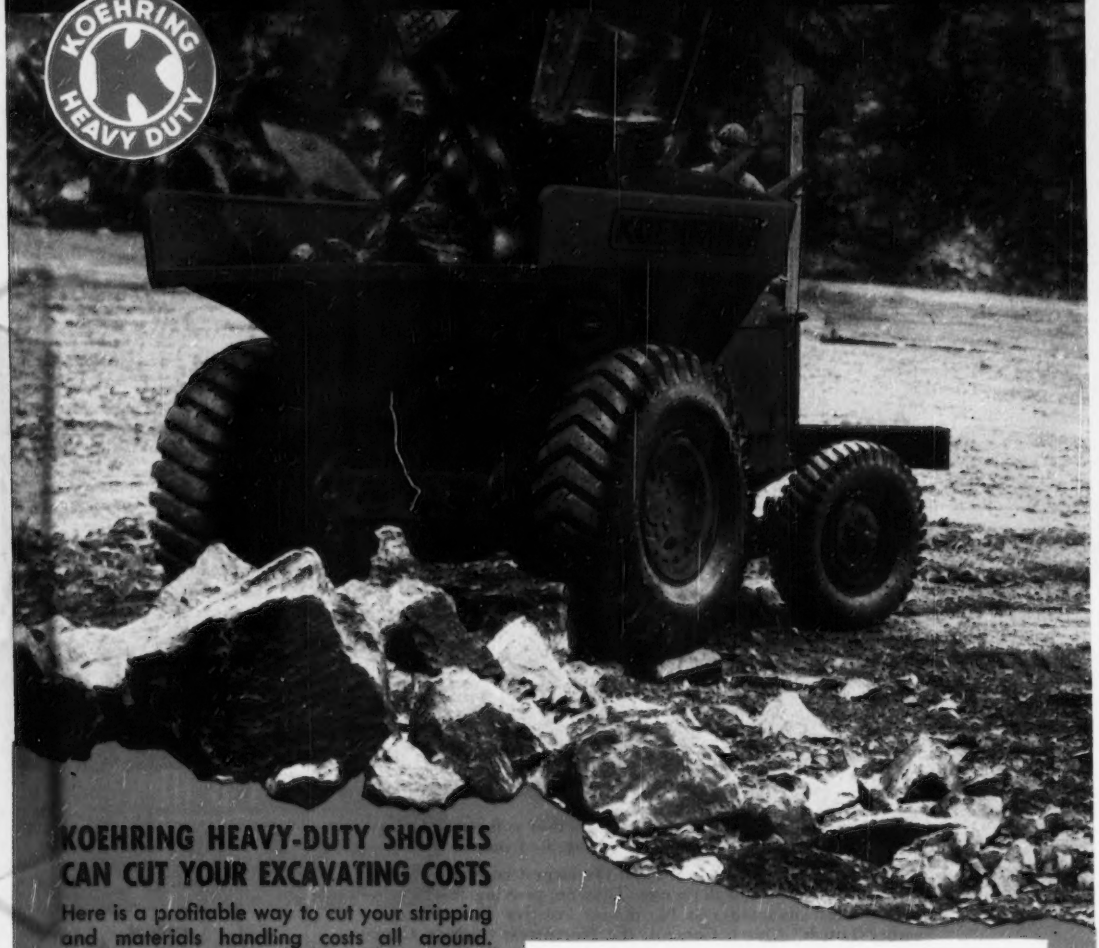
KOEHRING HEAVY DUTY



KOEHRING HEAVY-DUTY SHOVELS CAN CUT YOUR EXCAVATING COSTS

Here is a profitable way to cut your stripping and materials handling costs all around. Match high-speed Dumptor-hauling with dependable, heavy-duty Koehring excavators. It's a big production team, built to work together. Dumptor's heavy-duty construction, easy-loading design, fast hauling and dumping, match Koehring excavator's rugged digging ability and fast-operating speeds . . . give you matched speed and strength to keep output high, costs low. For complete facts on the big 1½-yard 605 (illustrated) . . . ¾-yard 304, or ½-yard 205 excavators, see your Koehring distributor . . . or write for bulletin. ASK, TOO, ABOUT BIG, 2½-YARD 1005

for *heavy hauling...*

DUMPTOR BODIES BUILT FOR HEAVY ROCK SERVICE

To meet the toughest hauling conditions of mine, quarry and construction service, Koehring Dumptors have a ton of strength for every ton of payload. Heavy-duty bodies stand up under the severest shocks of loading rock from big mine and quarry shovels. All-welded sides, ends and bottom are heavily ribbed with 4" channels. High-carbon steel gives extra strength at stress points where abrasive rock action is most severe. Three-layer bottom of seasoned 1-⅝" oak between two 5/16" steel plates cushions shocks.

HEAVY-DUTY CHASSIS TAKES ROUGH HAUL ROAD SHOCKS

Rugged, 8" ship-channel main frame . . . 4" chrome steel drive axles . . . and cast alloy-steel "I" beam steering axle, add extra strength to Dumptor chassis. Big tires absorb road shocks. There are no leaf springs . . . only one big-double-coil spring on oscillating steering axle. That means no spring shackles to lubricate . . . no spring maintenance. And . . . you have 6 HP for every ton of gross vehicle weight for faster acceleration, less shifting, more grade-ability. Dumptors climb grades up to 24% with full load.

NO BODY HOIST MAINTENANCE WITH GRAVITY DUMP

You don't lose time or spend money on body-hoist maintenance because Dumptors have no troublesome body hoists. Gravity dumps the full 6-yard load in one second. Free swinging, kick-out pan breaks suction, keeps dumping fast even in stickiest materials . . . adds an extra 3/16" steel to Dumptor bottom. Heavy-duty construction like this is your assurance that Koehring Dumptors will profitably stand up to your heaviest off-the-highway hauling assignments. Let your nearest Koehring distributor show you how.

KOEHRING COMPANY, Milwaukee 10, Wisconsin

Subsidiaries: PARSONS • JOHNSON • KWIK-MIX

Dumptor—Trademark Reg. U.S. Pat. Off. K809

How You Move Yardage Cheaper with the BIG RED team*

* International TD-24 Tractor and Bucyrus-Erie B-Type Scraper

By Fully Utilizing the TD-24

Bucyrus-Erie B-Type Scrapers apply the superior power and speed of this champion of tractors to haul bigger yardage at less cost than does any other tractor-scraper combination — including other scrapers working with TD-24's!

By Loading Big and Fast

The B-170 Scraper has greater struck capacity (15 yd.) than any other self-loading scraper. The B-250 is the largest scraper in current production (22 yd. struck capacity) available for use with any crawler tractor. Both models load easily, rapidly, with "boiling" action that keeps dirt uniform, reduces voids.

By Easy Hauling — Quick, Clean Dumping

Big tires keep scrapers "on top," with low rolling resistance. Goose-neck front permits sharp turns, easy maneuvering. B-Type Scrapers dump at traveling speed, with no stop for shifting.

Get complete details on why you move yardage cheaper with the Big Red team. Ask for a demonstration — and you'll be convinced!

For Smaller Size Scrapers

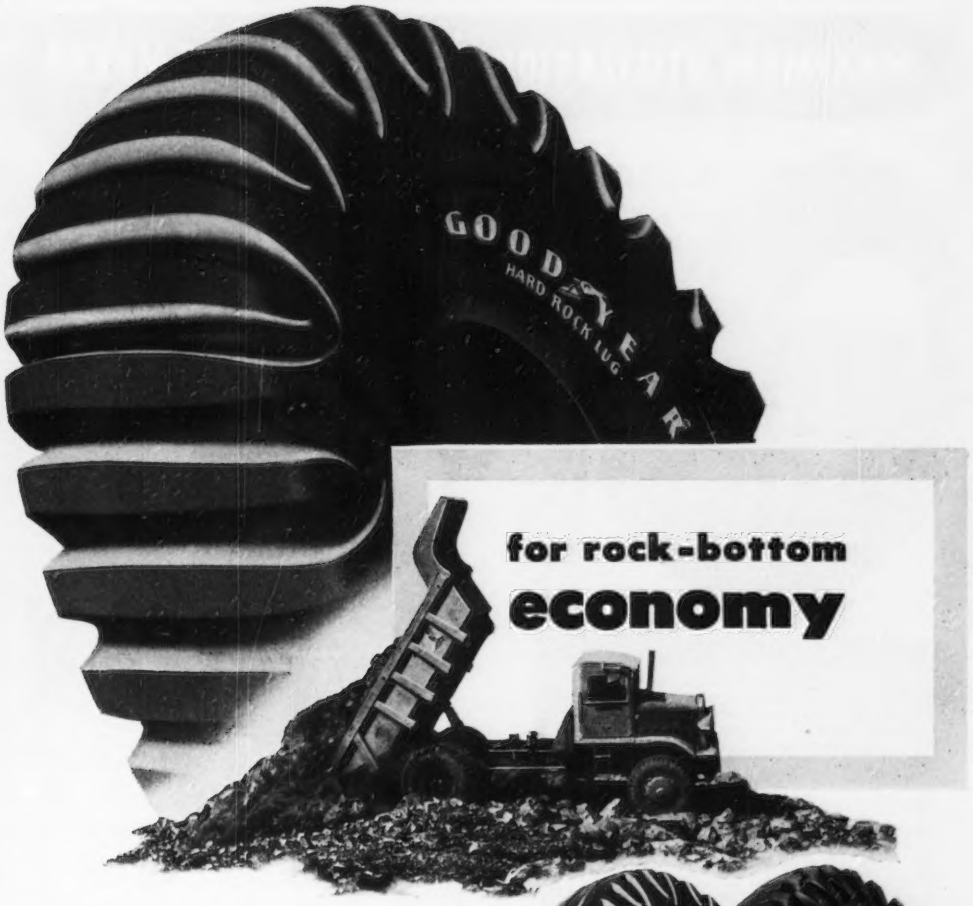
see the S-Type, rear-lift units in 4, 6, 8 and 10 yd. (struck) capacities.

Bucyrus-Erie Company

South Milwaukee, Wisconsin

224TSO

See Your INTERNATIONAL Industrial Tractor Distributor



GET the tire that's odds-on favorite with rock haulers everywhere—Goodyear's Hard Rock Lug. It's so tough you can't beat it for stamina and mileage on tire-killing rock work. Like all Goodyear work tires, the Hard Rock Lug is job-designed for maximum performance on a particular hauling job. Its carcass is extra-tough, is protected against bruising by an extra-thick undertread—big, tough lug bars armor its tread and sidewalls against cuts and rips—it provides positive traction, forward or reverse, with its self-cleaning universal tread. All in all it's your best bet for cutting costs—stepping up performance. Remember, always BUY and SPECIFY Goodyear—it pays!

THE HARD ROCK RIB

Companion tire for front wheels in rock work—specially designed to give you easier steering, smooth rolling, same tough body, same shoulder construction as the Hard Rock Lug.

THE ROAD LUG

Specially designed for trucks that operate both OFF and ON the road. This remarkable dual-purpose tire combines off-the-road toughness and traction with on-the-road mileage and economy.

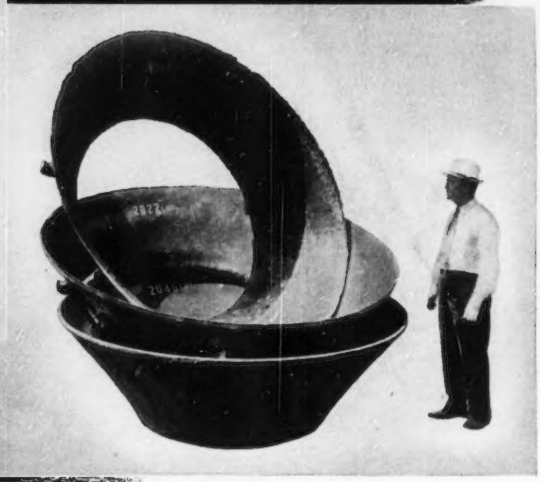
Road Lug—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

First—because proved best!

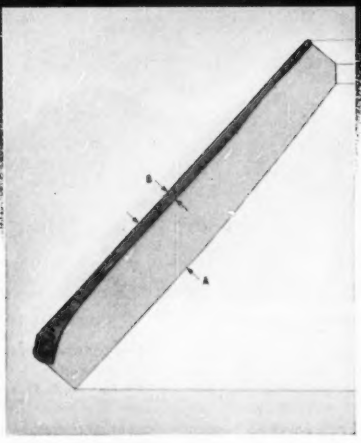
GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TIRES THAN ON ANY OTHER KIND

MAXIMUM UTILIZATION OF CRUSHING MEMBERS IN SYMONS CONES *Reduces* CRUSHING COSTS



The approximate weight of a new 7 foot Standard Cone Crusher bowl liner shown at the left is 6,700 pounds. The two worn out liners at the right with scrap weights of 1,632 and 2,022 pounds respectively have an average utilization of 73 percent.



The original thickness "A" of this manganese bowl liner is 3½ inches. When discarded, it had worn down to "B", with a thickness of about ⅜ inch or a utilization of 80 percent.

IF you do not get 65 to 75 percent utilization of your manganese crushing members, you are not operating at maximum efficiency. Maximum utilization with minimum scrap loss is essential to low crushing costs. Less frequent changes of manganese reduces crusher maintenance expense. Fewer shut-down periods maintain full production.

Maximum utilization and long life of manganese is a feature of the Symons Cone. Even on the hardest and most abrasive materials, Symons Cones will show a much lower manganese consumption than other types of crushing equipment used in the same service. To be assured of more production and greater profits, use Symons Cones for your reduction crushing operation.

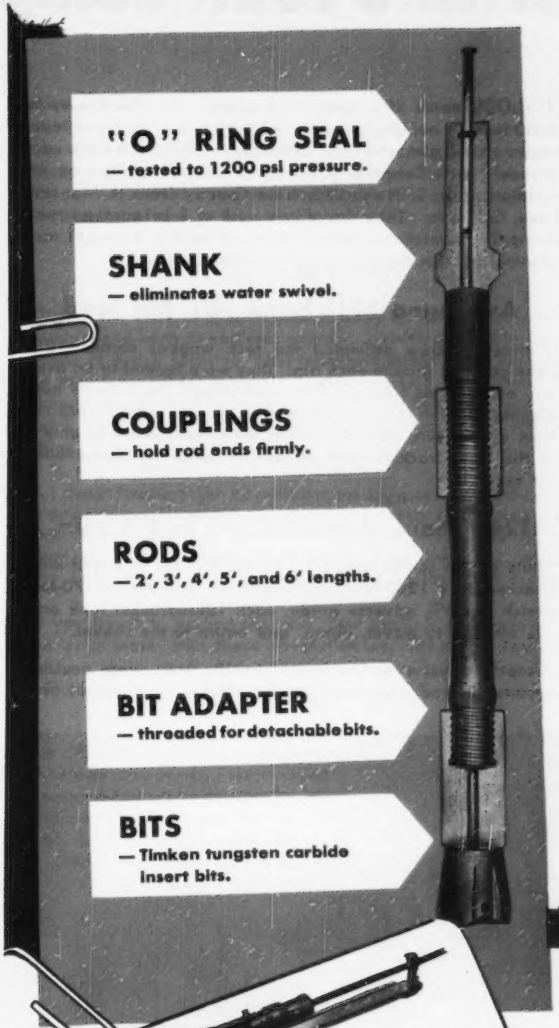
NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN

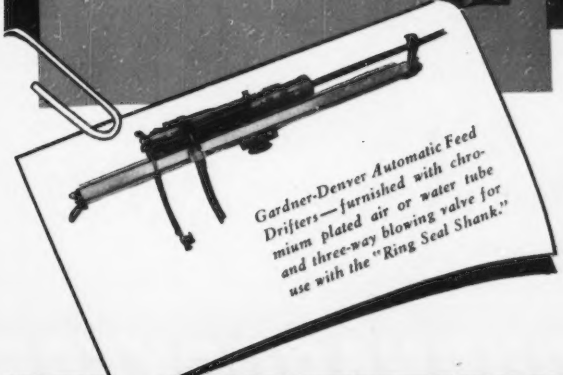
NEW YORK · SAN FRANCISCO · WASHINGTON · LONDON · TORONTO · JOHANNESBURG

NORDBERG MACHINERY

SYMONS CONE CRUSHERS

TODAY'S BIGGEST NEWS IN DEEP HOLE DRILLING




Gardner-Denver Automatic Feed Drifters—furnished with chromium plated air or water tube and three-way blowing valve for use with the "Ring Seal Shank."

GARDNER-DENVER DEEP HOLE DRILLING EQUIPMENT WITH "RING SEAL SHANK"

Here's a whole new set of field-proved drilling equipment that will revolutionize your deep hole drilling. Now, for the first time, you can take full advantage of tungsten carbide insert bits and modern rock drill power for faster, lower cost deep hole drilling.

No more water swivel troubles

The new Gardner-Denver "Ring Seal Shank" replaces the old type water swivel at a fraction of the cost—eliminates water swivel troubles.

Higher blowing pressures

"Ring Seal Shank" delivers water or air at any pressure that can be used on deep hole drilling—assures positive hole cleaning.

Longer rod and coupling life

Gardner-Denver sectional rods and couplings withstand the shock and grind of deep hole drilling—last much longer than conventional equipment — because they're manufactured with the same skill and precision as rock drill parts. Rod design has been carefully engineered to minimize stress concentrations and to form a tight union between all parts.

Tested and proved in the field

Gardner-Denver deep hole drilling equipment has been widely field tested—is now in use in many United States and Canadian mines—drills prospect holes at a fraction of the cost of diamond drilling.

Write today for complete information.

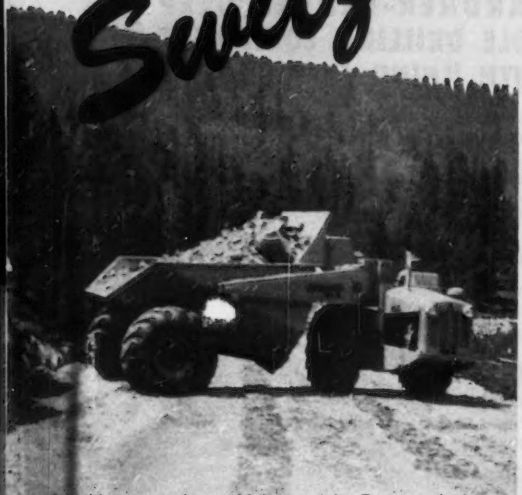
GARDNER-DENVER

Since 1859

Gardner-Denver Company, Quincy, Illinois.

In Canada:
Gardner-Denver Company (Canada) Ltd.,
Toronto, Ontario.

Horner and Switzer move 220,000 with 3 rear-dump



On this mountainous highway job, Tournarocker's quick, easy maneuvering cut important seconds off every haul cycle. Ability of the 2-wheel prime mover to make 90° turns gives the big Tournarocker a short turning radius of 12'6"... and it really paid off here.

220,000 yards of mountain-top granite . . . altitudes up to 8300 feet . . . narrow, precipitous haul trails . . . and continual heavy rains, almost every other day. Those were the conditions which Contractors Horner & Switzer tackled on relocation of U. S. Hwy. 280, from Granby Dam to Monarch Lake, Colorado. They drove in a fleet of 3 LeTourneau rear-dump Tournarockers, teamed them up with a 2½-yard rock shovel, and got the following big-yardage results:

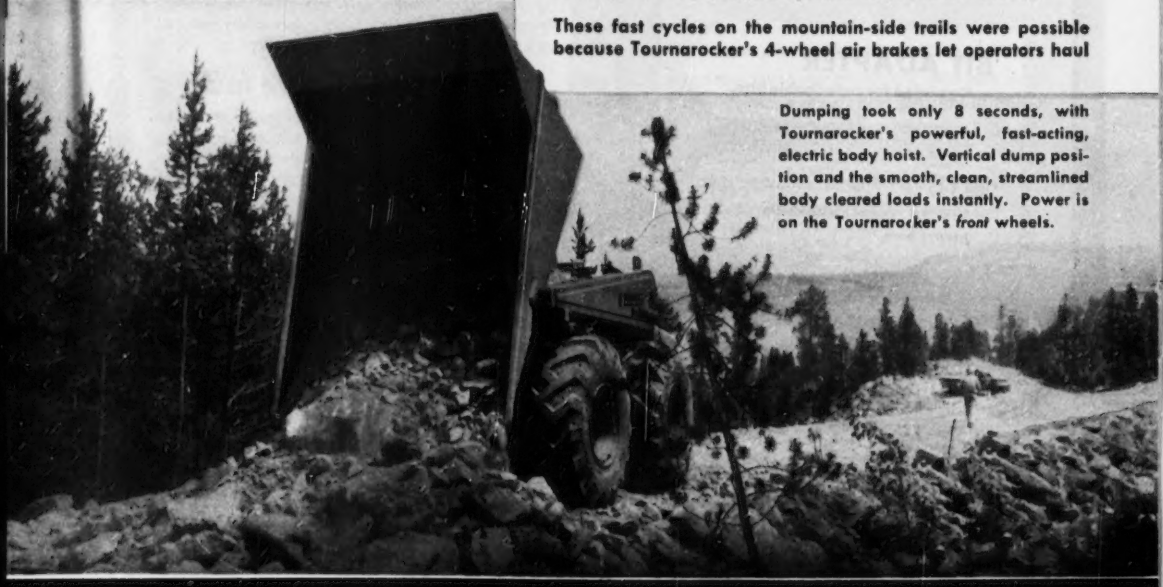
Averaged 10½ bank yds. per load

Contractor's crew estimated the rock wagons carried 10½ bank yards of granite each trip. They were loaded in an average of 7 passes from the 2½-yard dipper. In extreme hard digging, it often took the shovel 4½ minutes to load each rig. Haul cycles were so fast that on most haul distances only 2 of the Tournarockers were needed to keep the shovel busy. For example:

1240' haul, dump, return in 4¼ min.

Hauls on the job ranged from a few feet up to a half-mile. Checked on a 1240-foot, one-way haul, including a 170-foot stretch of 13% adverse grade, each Tournarocker took only 4¼ minutes to travel, dump, and return to the shovel.

These fast cycles on the mountain-side trails were possible because Tournarocker's 4-wheel air brakes let operators haul



Dumping took only 8 seconds, with Tournarocker's powerful, fast-acting, electric body hoist. Vertical dump position and the smooth, clean, streamlined body cleared loads instantly. Power is on the Tournarocker's *front* wheels.

LETOURNEAU PEORIA, ILLINOIS **TOURNAROCKERS**

TRACTION ADVANTAGES of A CRAWLER PLUS HIGH-SPEED on RUBBER

Yds. MOUNTAIN GRANITE
TOURNAROCKERS

heavy loads at maximum speeds with complete safety. 4,108 square inches of braking surface . . . *more on one wheel than most haulers have on all four wheels* . . . gave sure, safe stops every time. Short, 90° turns, and positive electric steer by push-button control, permitted quick turning and spotting on the dump and at the shovel.

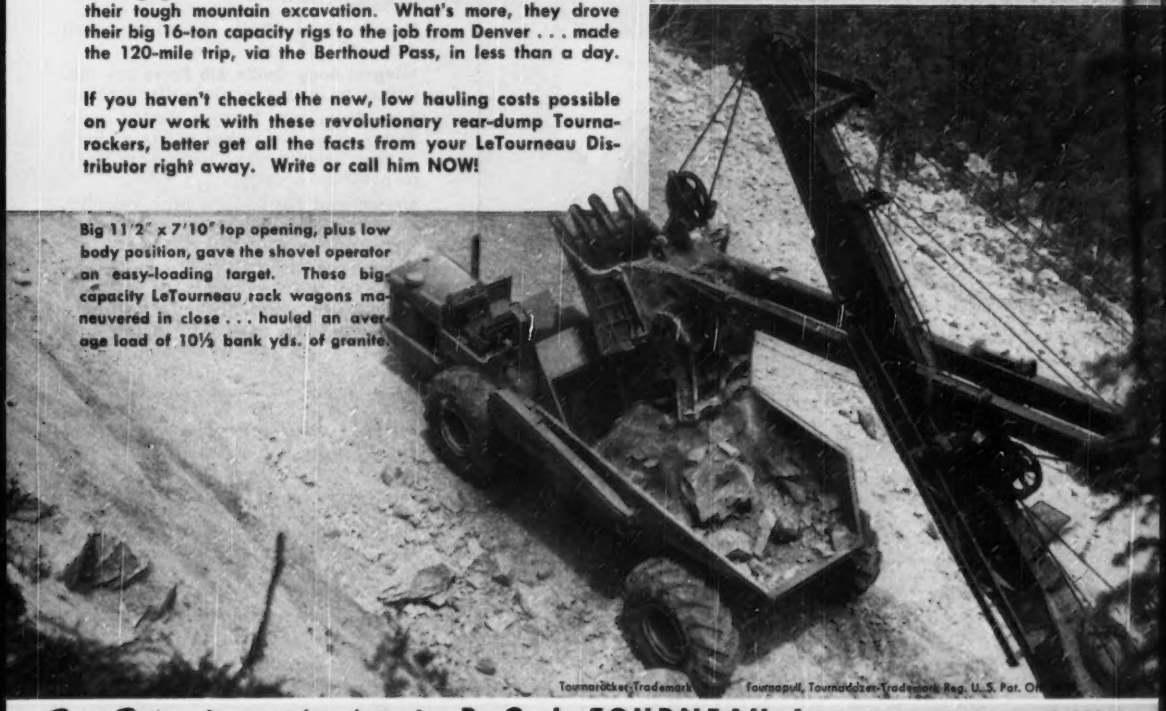
8-second dump

Dump was fast . . . simple, electric body hoist tilted the wide, streamlined body to vertical position . . . cleared the 10½-yard loads in just 8 seconds, total hoist and dump time. Because of their front-wheel drive, and holding action of powerful 4-wheel brakes, the Tournarockers safely backed up to edge of bank, and dumped loads over the bank eliminating rehandling . . . saving dozer clean-up.

All these Tournarocker advantages for big-payload, fast-cycle hauling gave Horner & Switzer the lowest-cost answer on their tough mountain excavation. What's more, they drove their big 16-ton capacity rigs to the job from Denver . . . made the 120-mile trip, via the Berthoud Pass, in less than a day.

If you haven't checked the new, low hauling costs possible on your work with these revolutionary rear-dump Tournarockers, better get all the facts from your LeTourneau Distributor right away. Write or call him NOW!

Operating on narrow ledge at the shovel, Horner & Switzer's Tournarockers turned and spotted into loading position in an average of 24 seconds. Giant, 4-wheel air brakes and positive electric power steer gave operators complete confidence and safety.



Big 11'2" x 7'10" top opening, plus low body position, gave the shovel operator an easy-loading target. These big-capacity LeTourneau rock wagons maneuvered in close . . . hauled an average load of 10½ bank yds. of granite.

Tournarocker-Trademark Tournapull, Tournadozer-Trademark Reg. U. S. Pat. Off.

Send Today for complete facts to R. G. LeTOURNEAU, Inc., Peoria, Ill.

We're interested in . . . ☐ specifications ☐ price ☐ job analysis on the 16-ton, rear-dump, E16 Tournarocker

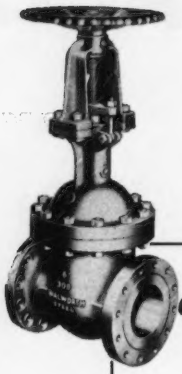
NAME..... TITLE.....

COMPANY..... TYPE OF BUSINESS.....

STREET..... CITY..... STATE.....

Would also like information on ☐ 13.5-yard C Tournapull ☐ 7-yard D Tournapull ☐ rubber-tired Super C Tournadozer

LeTOURNEAU LET EQUIPMENT



WALWORTH

Cast Steel Gate Valves

Series 150 and 300

Wedge Gate — Outside Screw and Yoke

Sectional view of Series 300

Big 8-Point Superiority!

Gland clearances are such that stem cannot be scored if gland should be tightened unevenly.

Deep Stuffing Boxes in all sizes (2" to 24") insure tightness and maximum packing life — costly leaks are eliminated.

Bonnets and Bodies are engineered to withstand pressure and minimize distortion — they're tough, durable, dependable.

Heavy Steel Walls provide extra strength and longer life.

Integral Body Guide Rib Faces are machined to insure accurate disc seating.

Seat Rings are bottom seated — not flange type. No recess exists at back of ring — hence no turbulence, erosion, or pressure drop.

Streamlined Ports allow high velocity, non-turbulent flow, and reduce the possibility of erosion.

Valves regularly have flanged ends. They can be supplied with ends for butt welding. Roller bearing yokes are available. On valves 5 inches and larger, by-passes can be furnished.

For Series 600 and higher, we recommend Walworth Pressure-Seal Steel Gate Valves.

For further information on Walworth Cast Steel Gate Valves, see your local Walworth distributor, or write:

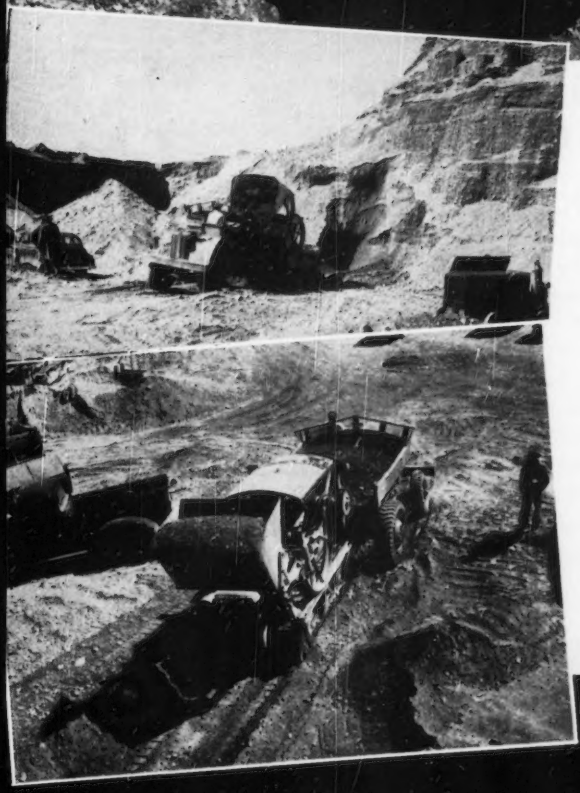
WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

EIMCO RockerShovel 104



Eimco 104 RockerShovel loading sand and gravel (weight: 125 lbs. per cu. ft.) at the rate of 8 yards per minute.

"A crawler-mounted RockerShovel for rock." This is the cry we've heard from RockerShovel users for many years—and now, after years of field testing, we have the machine our friends have asked for.

The 104 Eimco RockerShovel is the same rugged type of machine that has been the preferred loading equipment underground for many years—the same overhead principle pioneered by Eimco — the same heavy-duty construction throughout.

The Eimco 104 RockerShovel is designed for loading heavy, abrasive rock or sand and gravel using a 1¼ yard bucket for heavy rock, and a 2 yard bucket for sand and gravel. The 104 is available with a 48 H.P. Diesel engine, or 30 H.P. Electric motor.

This machine is ideal for loading, bulldozing, or cleaning in roadwork, quarries, stock piles, and mines. Operators are finding new uses for it every day.

Write for more information.

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 8, UTAH, U. S. A.

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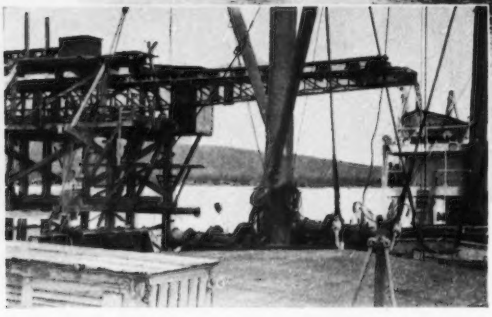
The World's Largest Manufacturers of Underground Rock Loading Machines



Sea-Going Conveyor

CUTS PORT TIME FOR ORE SHIPS!

This S-A belt conveyor system, which replaces a Philippine Island installation destroyed during the war, stock-piles iron ore brought by rail car from an inland mine to the dock. The ore is later reclaimed, as needed, for loading ships. In this way, continuous mining can be carried on and ships loaded as they arrive. Fast loading assures low cost handling and minimum port time for every ship.

As designers and manufacturers of *all types* of bulk materials handling equipment, Stephens-Adamson engineers are free to recommend that best suited to your specific needs. For nearly fifty years they have aided industries of varied requirements in all parts of the world to move all kinds of bulk materials at the *lowest cost per ton.*

If you plan to install a complete new handling system, or merely to replace units, draw on S-A experience by inviting an S-A engineer to talk over your needs. Write today!

SAMAR MINING COMPANY
SAMAR, PHILIPPINE ISLANDS

Ore is transported 5½ miles by rail car from the mine to the boat loading conveyors at the dock. The belt conveyor from stock pile, mounted on a specially-built pier, extends out to deep water where boats can dock. A shuttle conveyor at the ship's end of the conveyor system provides loading flexibility. It can be positioned directly over a ship's hold. From October to December, 1949, this system handled 96,000 tons of ore, in spite of heavy rains during the typhoon season.

STEPHEN S-A DAMSON
MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

No. 1 DIESEL for Tough Jobs

One of a fleet of seven Euclid rear dump trucks, powered by GM Series 71 Diesels, working 16 hours a day in the phosphate mine of Simplot Fertilizer Co., Pocatello, Idaho.

IN rugged strip mining work all over the country, more and more operators rely on General Motors Series 71 Diesel engines for sure, dependable power and low-cost operation.

Because they are two-cycle, these engines deliver power at *every* piston downstroke rather than every other downstroke as do 4-cycle Diesels. This makes them easy to start, doubly smooth and powerful and more responsive to varying load demands. Their clean design and interchangeable parts make them simple to service, easy to keep at top efficiency.

Above all, these sturdy GM Diesels can be relied upon to do their jobs dependably and efficiently, month in and month out, with a minimum of attention. And, as with all General Motors products, factory-engineered parts are readily available when needed.

Whatever your need for power—in trucks, tractors, shovels—on pumps, compressors or drills—this engine will fill it efficiently and economically. Single engines, "Twins" and "Quads" supply a horsepower range to fit your job. We'll be glad to furnish other facts—just write or call.

DETROIT DIESEL ENGINE DIVISION

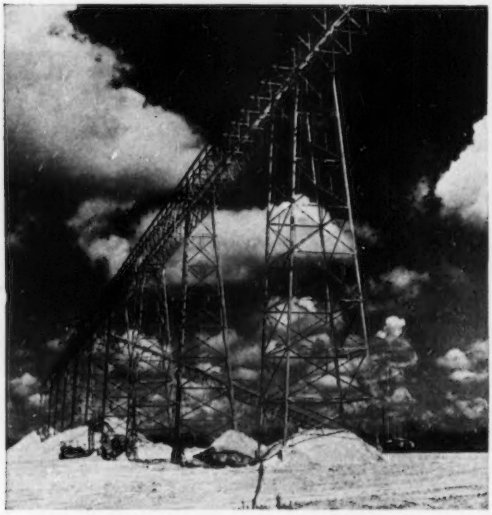
SINGLE ENGINES...Up to 275 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS...Up to 800 H.P.

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

DIESEL BRAWN WITHOUT THE BULK

FROM START...TO FINISH



Wet rock storage area showing incline belt to trestle and trestle shuttle belt. A bulldozer pushes rock down hopper onto tunnel belt.

Incline belt to dryer receiving wet rock from tunnel reclaiming belt. View also shows dry rock storage belt gallery.

U. S. CONVEYOR BELTS INSURE CONTINUOUS FLOW OF PHOSPHATE ROCK

Diagram of continuous flow in phosphate rock handling field. U. S. Belting literally does all the haulage—from start to finish.

This is a good example of first-class mechanization in phosphate rock handling. U.S. Rubber Company conveyor belts carry the rock above and below ground to processing and after processing to point of shipment. U. S. Oil Resisting Belts are used on the trestle incline and shuttle, and in the reclaiming tunnel and dryer incline. These belts are specially compounded to resist the action of oily reagents clinging to wet rock. The covers of the belts are specially built to withstand the deteriorating effect of the hot sun's rays.

The dry rock storage belt is a special U. S. Hot Lump Belt of great ruggedness, especially resistant to the destructive effect of the heat from the hot, dry rock.

"U.S." belt experts are constantly finding new ways to make belting save you more money, step up your output. When you plan a new conveyor system, or when you wish to replace your present belt, get in touch with United States Rubber Company engineers.

A PRODUCT OF U.S. RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

DU PONT ANNOUNCES "NITRAMEX" No 2

for quarry and open-pit blasting

Charges of "Nitramex" No. 2 are detonated with a "Nitramon" Primer. Note ingenious method of securing "Primacord."

"Nitramex"* No. 2 is another product of Du Pont Explosives Research . . . introduced now after extensive field tests have proved its value in blasting both rock and ore. It fulfills the need for a high-density blasting agent that develops its pressure more slowly, yet offers all the safety factors of "Nitramex," which has been used so successfully in ore and quarry applications.

The slower development of pressure . . . characteristic of "Nitramex" No. 2 . . . produces a better spreading action, giving more uniform fragmentation under a wider variety of conditions. This action frequently allows an increase in spacing and burden with as good or better fragmentation, saving both drilling and blasting costs.

The introduction of "Nitramex" No. 2 rounds out the line of "Nitramon"**-"Nitramex" blasting agents and marks another step forward in the Du Pont Company's program for safer blasting in quarries and open pits.

Ask your Du Pont Explosives Representative about this new, more effective blasting agent. E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., Wilmington 98, Delaware.

DU PONT "NITRAMEX"

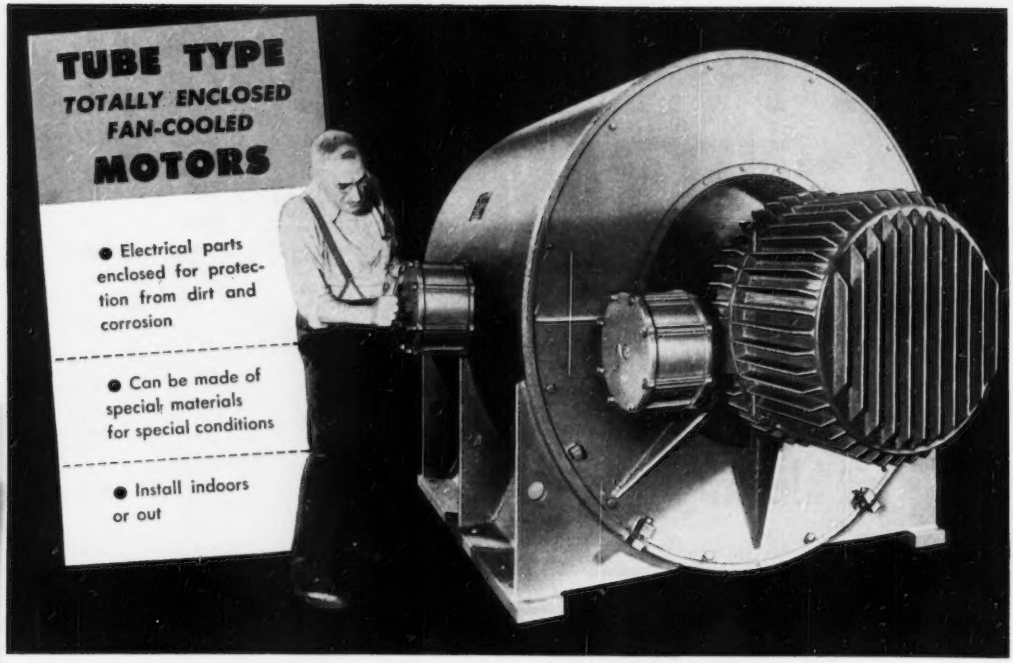
Not currently for sale in the western states.

*Reg. trade mark for ammonium nitrate blasting agent
**Reg. trade mark for nitrocarbonitrate blasting agent

DU PONT

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

This splendid fragmentation is typical of "Nitramex" No. 2 blasts.


TUBE TYPE
TOTALLY ENCLOSED
FAN-COOLED
MOTORS
● Electrical parts enclosed for protection from dirt and corrosion
● Can be made of special materials for special conditions
● Install indoors or out

DIRT'S OUT...
AND SO IS CORROSION!

YOU KEEP DIRT and chemicals away from all electrical parts — including stator core with Allis-Chalmers tube-type motor. In addition, tubes, stator end plates, and external fan can be made of corrosion resistant metals that will not be attacked by atmospheric acids or alkalies.

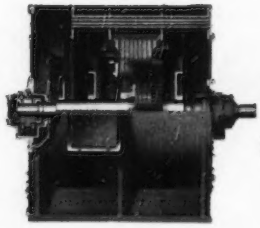
Cleaning is rarely needed because air passages are unrestricted. Air flow is through straight tubes. Residual foreign matter is reduced to a minimum.

This unique cooling system for motors reduces maintenance to a point never before reached in totally enclosed motor design.

Install this motor indoors or outdoors in any atmosphere. Important savings have been proved by years of field operation. Sizes from 75 hp and up. Also explosion proof designs. And you can match these motors with Allis-Chalmers starters. For complete information outline your requirements to your A-C Sales Office, or write for Booklets 7149 and 7150.

A-3037

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.



HOW TUBE-TYPE COOLING SYSTEM SAVES YOU MONEY ON MAINTENANCE

1. **LARGE HEAT TRANSFER AREA** of tubes plus efficient air flow removes heat quickly.
2. **STRAIGHT TUBES** do not normally clog or collect moisture and foreign matter.
3. **INTERNAL FANS** keep enclosed air constantly circulating, assuring even cooling and fast heat dispersal.
4. **EXTERNAL FAN** blows air through tubes to remove heat quickly and efficiently. Air speed keeps tubes clean.
5. **ALL ELECTRICAL PARTS ARE ENCLOSED:** Dirt cannot enter.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Where Service Life Counts Most

COMMERCIAL FUEL CO. USES J&L WIRE ROPE

J&L STEEL

Marion 5560 with a 32-yard bucket (above) and (right) Bucyrus-Erie 500-W dragline moving overburden for Commercial Fuel Company. These machines uncover more than one million tons of coal per year—use J&L Wire Rope to cut costs.

J&L Hoist Ropes and Draglines Pay Off in Cubic Yard Mileage on Big Equipment

Commercial Fuel Company knows that strip mine profits really take a beating when a 32-cubic-yard shovel bucket and a twelve-yard dragline have to stop moving overburden because of a breakdown. That's why Commercial Fuel Co. cuts downtime to a minimum by using J&L hoist ropes on its huge Marion 5560 Shovel and J&L draglines on its Bucyrus-Erie 500W.

Stripping two pits near Cumberland, Ohio, these two machines remove an average of 50 feet of overburden from the more than a million tons of coal that Commercial Fuel Co. mines each year. Operating on a schedule such as this, big equipment has to produce and *keep on producing*—or loading, hauling equipment and men are forced into costly idleness.

Commercial Fuel Co. knows how to keep its equipment producing. Records show that J&L Wire Rope can be counted on for *extra* economy through longer service life—less equipment downtime. Long life is a built-in feature of J&L wire rope.

Quality is controlled by J&L in every step of manufacture from the mining of the ore through the final stranding and closing operations.

ATTENTION
MANUFACTURERS • OPERATORS

If you build or operate shovels, draglines, scrapers, or any other type of equipment where wire rope is important to economy and efficiency of operation, contact J&L for information regarding the specific design of wire rope that will do the best job for you.

Jones & Laughlin Steel Corporation
412 Jones & Laughlin Building
Pittsburgh 30, Pennsylvania

I am interested in using the right wire rope for the job. Please send me a free copy of your handbook "Wire Rope is a Machine."

NAME_____

COMPANY_____

ADDRESS_____

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY (*hi-tensile steels*).

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

Look for the name AMSCO®* on the dipper you specify...

Amsco Engineering — plus Amsco Manganese Steel Construction — means more efficient, more profitable shovel operation.

Profit is determined by *handling costs per yard,* and here are 2 important reasons why you can lower those handling costs with AMSCO Dippers:

Austenitic Manganese Steel—For Longer Life— The more you use an Amsco dipper, made of manganese steel throughout, the harder it gets! Surfaces that are subject to impact and abrasion actually work-harden and take on a high polish for added wear-resistance.

Manganese Steel—"the toughest steel known"—withstands the most severe breaking stresses.

AMSCO Engineering—For Better Operation— Years of Amsco design experience bring you a *complete line,* from which you can select dippers "custom-engineered" to your own requirements . . . for deep penetration, full loading and positive dumping. Whether you need manganese steel Welded, Missabe, Renewable Lip types, or special designs for unusual service, *you'll get longer wearing life and greater economy when you specify Amsco.*

NOW! Prompt delivery of Amsco Dippers and Parts

AMSCO®
WELDING PRODUCTS

The fast, low-cost way to get worn or damaged equipment back in service.

Amsco hardfacing rods make important on-the-job savings . . . keep down time at a minimum. Contact your supply house or Amsco representative for information on the complete Amsco line of Welding Rod, Weldments and Repointer Bars.

Get the facts on the complete Amsco Line . . .

This 40-Page booklet is packed with information on Amsco Dippers, and parts for shovels and draglines. Write today for your free copy . . . ask for Bulletin No. 547 DS.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
376 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Step Up Recoveries

WITH THESE TWO FLOTATION "FIRSTS"

Yarmor® F Pine Oil

Hercules "Yarmor" F Pine Oil has been a standard of quality among pine oils ever since the flotation process became established. Low in cost, it is recognized as the ideal frother for the flotation of sulphide minerals, such as zinc, copper, lead . . . and for non-sulphide minerals, such as mica, quartz, graphite, feldspar, and talc. A relatively new and profitable use is in the salvaging of coal fines for fuel. Here, as wherever a highly mineralized froth is required to support and hold heavy concentrations, "Yarmor" F Pine Oil assures maximum recovery.

Rosin Amine D Acetate

Rosin Amine D Acetate is a new type of collector developed by Hercules for the flotation process. This cationic surface-active material is low in price, has good solubility, and is easy to handle. Rosin Amine D Acetate is employed in the flotation of non-metallic ores, such as feldspar, cement rock, and phosphate rock. It is an excellent collector for silica and siliceous minerals, and may have application in the removal of these substances from other ores. Hercules Rosin Amine D Acetate is shipped to flotation users in the form of a water-soluble, 70 per cent paste.

Send for new technical book on Hercules flotation agents

HERCULES POWDER COMPANY

INCORPORATED

933 KING STREET, WILMINGTON 99, DELAWARE

NM50-2

"GUILLOTINE" TEST
Proves 50% MORE CUSHION in *Homocord* CONVEYOR BELTS

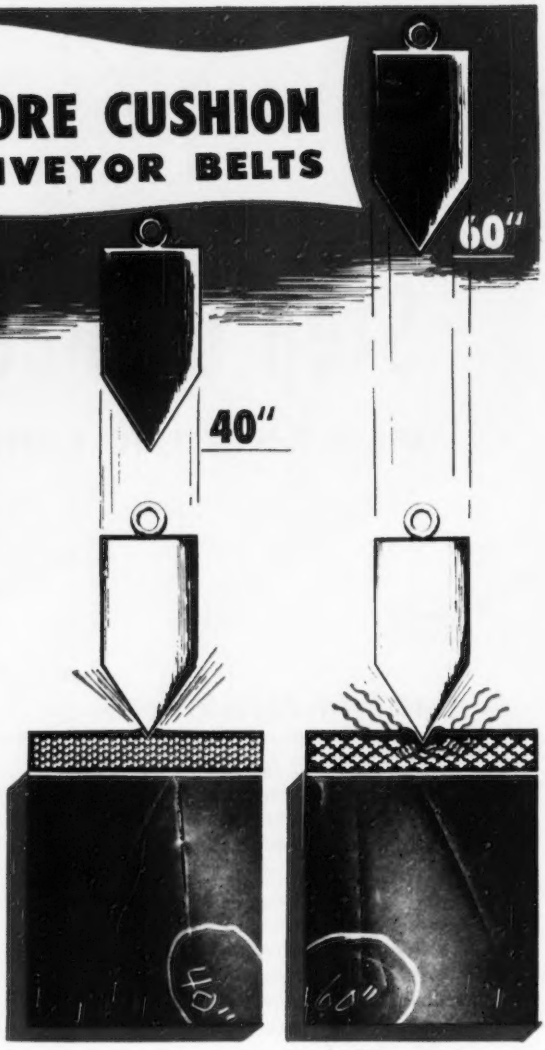
When rocks like those shown here drop on a conveyor belt, every shock at loading point shortens the life of the belt. To overcome this, extreme cushion and resilience are built into Homocord Conveyor Belts: This "Through-and-Through" Cushion gives Homocord Conveyor Belts longer life than any other belt.

To measure comparative cushion and shock-absorbing qualities, Raybestos-Manhattan engineers devised the "killer" test shown at right. A heavy metal weight, ground to a blunt edge is dropped from various measured heights until it ruptures the cover of the sample under test.

Notice the shock lines indicate how a regular conveyor belt's "boardy" resistance to impact leads to cover gouging and breakdown. The shock lines on the Homocord cross section show how "Through-and Through" cushion and resilience of the Homocords absorb impact without injury.

Homocord CUSHIONED CONSTRUCTION HAS 8 ADVANTAGES

1. Complete bonding of every member into a homogeneous structure.
2. Holds metal fasteners, with no loss of draw-bar strength.
3. Lateral flexibility permits perfect troughing, accurate training, reduces fatigue of flexing at bend in troughing idlers.
4. Resists destructive action of continuous or heavy impact feeding.
5. Cushion Homocord body and low inelastic stretch reduce wear and tear of top cover.
6. Homocord body reduces hazard of punctures.
7. The Homocords are completely encased in Flexlastics; moisture not admitted, mildew cannot start.
8. Longer life, lower cost per ton.



REGULAR DUCK BELT

Unretouched photo shows actual rupture results of a 40" Guillotine Drop Test on a conventional 4-ply 32-oz. duck belt with 1/8" top cover, 1/16" bottom cover. With little cushion to absorb impact, the cover ruptures and deterioration sets in.

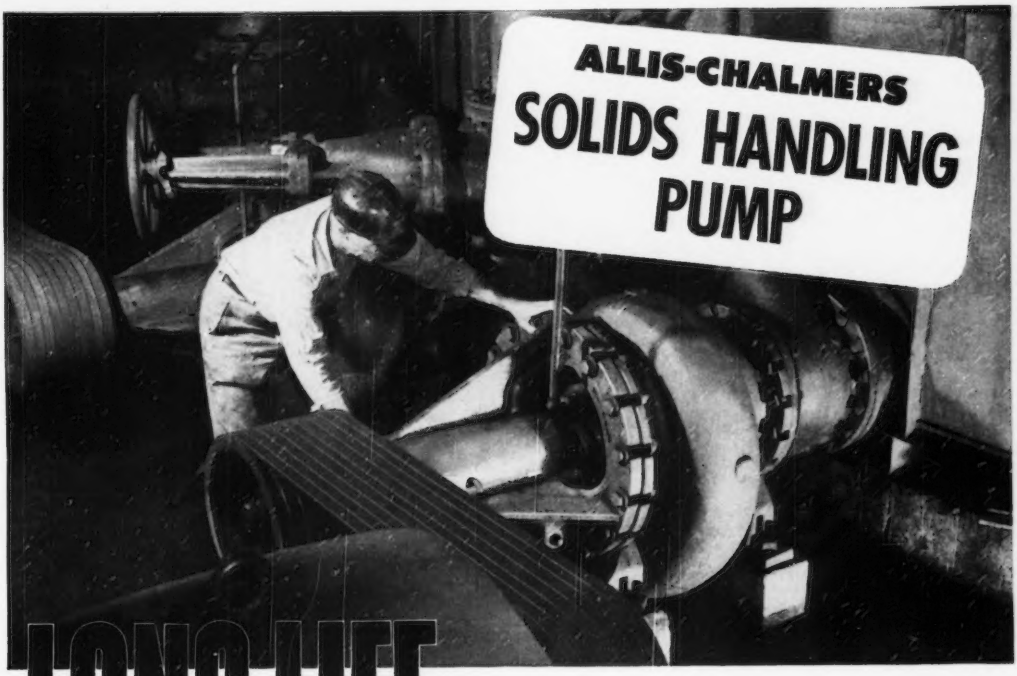
Homocord

Unretouched photo shows comparable degree of impact effect from a 60" Guillotine Drop Test on a 4-ply AEH Homocord Conveyor Belt with 1/8" top cover and 1/16" bottom cover. Impact of falling weight is dissipated through the Homocords, cushioned in Flexlastics.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls



LONG LIFE plus easy servicing

GIVE YOU LOWER PUMPING COSTS

USERS HAVE REPORTED as much as four times longer life with Allis-Chalmers solids handling pumps because they are made of special hard *Allisite* alloy . . . because they have thicker sections and heavier parts throughout . . . and because they are application engineered by specialists who know solids handling problems and how to solve them.

Replace Worn Parts In Half Hour

When parts must be replaced, as they must in all solids handling pumps, you will save many hours of time and many dollars of expense with the Allis-Chalmers solids handling pump. This pump is designed with only five wearing parts, all made for easy handling and replacement. The pump can be torn down, an element replaced and the pump reassembled in less than a half hour. Piping need not be disturbed unless casing must be replaced.

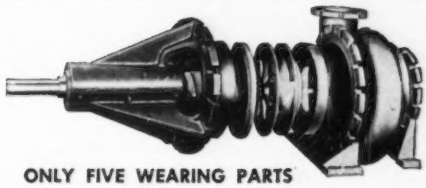
Three sets of bearings, brackets and shafts cover all pump sizes making spare parts inventory low regardless of the number of pumps you operate. Head and capacity can be changed instantly when the drive is equipped with the new *Vari-Pitch* Automatic sheave and *Texrope* V-belt drive.

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

Get The Facts Now

Discuss your solids handling equipment problems with an Allis-Chalmers pump engineer. He can show you dollars and cents savings you can make. Contact your A-C Sales Office today. Or write for Bulletin 08B6381. A-2988

Vari-Pitch, Texrope and *Allisite* are Allis-Chalmers trademarks.



ONLY FIVE WEARING PARTS

Shaft sleeve, impeller, casing, two wear plates. All easy to handle and easy to replace.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Now Available on Request

A SIGNIFICANT NEW TECHNICAL PAPER

MINERAL DRESSING NOTES #17

Chemistry of Cyanidation

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Presented before the February 1950 meeting of the A.I.M.E. by Norman Hedley and Howard Tabachnick of the Cyanamid Mineral Dressing Laboratory, this 40-page paper is the first of a series on Cyanidation. It is a basic text on the chemistry of the cyanidation process, as well as a resume of technical data on the effect and control of Cyanogen Complexes. A substantial part of the contents is new information resulting from Cyanamid research and laboratory investigation.

Several years in preparation, *Mineral Dressing Notes #17* will, we believe, be a worthwhile addition to current technical literature, helpful to every metallurgist and mill man interested in cyanidation.

For over half the sixty years since the first cyanidation plant was built at Robinson Deep, Cyanamid has been an important Cyanide producer. "Aero Brand Cyanide" was our first metallurgical chemical . . . still is widely used by important mills the world over. Thus, we have an enlightened self-interest in advancing the cyanidation process through the research, testing, application work and technical reports of the Cyanamid Mineral Dressing Laboratory and Cyanamid Field Engineers.

SENT ON REQUEST

Because of its specialized content, copies of *Mineral Dressing Notes #17* have not been sent to all who customarily receive the publications of the Cyanamid Mineral Dressing Laboratory. If you are interested in cyanidation and did not receive a copy, we will be pleased to send one on request. The coupon below is included for your convenience.

AMERICAN *Cyanamid* COMPANY

MINERAL DRESSING DIVISION

30 ROCKEFELLER PLAZA NEW YORK 20, NEW YORK

Mineral Dressing Division
American Cyanamid Company
30 Rockefeller Plaza, New York 20, N. Y.

Kindly send me a copy of *Mineral Dressing Notes #17*, "CHEMISTRY OF CYANIDATION"

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COMPANY _____

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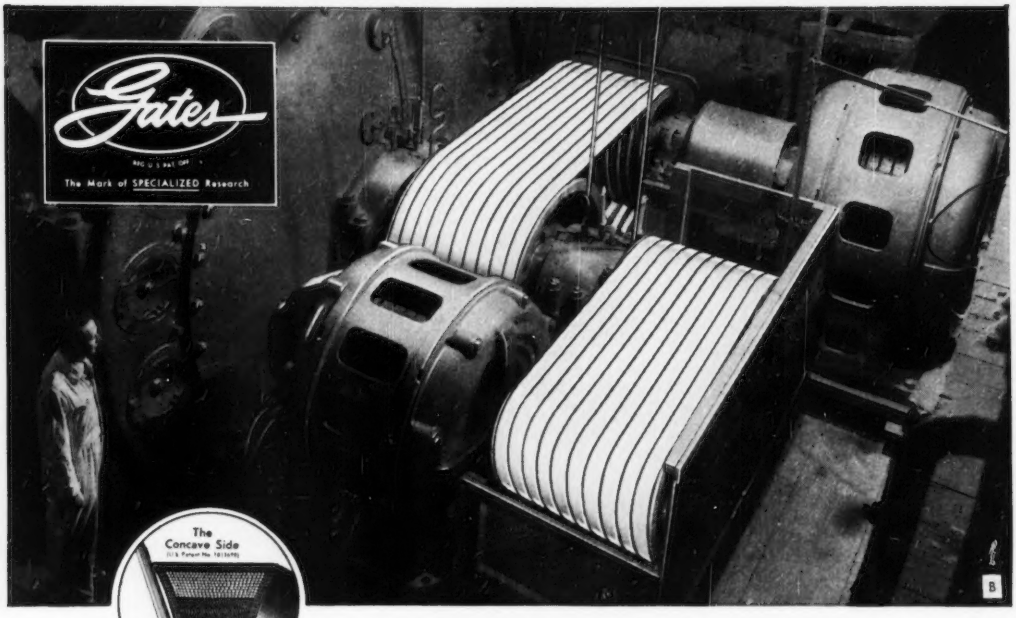


The motor in the background transmits 600 horsepower through a hollow shaft to one impeller of this crusher while the motor in the foreground transmits 400 horsepower to the other impeller turning it in the opposite direction. The Gates Vulco Ropes absorb the terrific shocks encountered when hard copper ores are crushed between these impellers—are not bothered by the dust condition present.

Here is exactly *WHY* the Concave Side Saves You Money in V-Belt Costs

When *any* V-belt bends in going around its pulley, it is forced to *change* its *shape*.

Naturally so, because the top of the belt is under tension and grows *narrower* while the body, under compression, *bulges out!*

This change of shape in a *straight-sided* V-Belt, is shown in figures 1 and 1-A—and you will note how the bulging sides press *unevenly* against the V-pulley.

Now look at figures 2 and 2-A. There you see how this change of shape, due to bending, affects the belt that is built with the Concave Side—the Gates Vulco Rope. The precisely engineered Concave Side exactly corrects the side-bulge—and the bent belt *has a shape that exactly fits its sheave groove!*

Two distinct savings result. *First*—There is no side-bulge to cause uneven wear. The sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in *longer life!* Second—The *full width* of the sidewall grips the pulley—thus carrying heavier loads without slippage—and this *saves belts* and also saves *power!*

When you buy V-Belts, be sure you get the V-Belt with the Concave Sides... the Gates Vulco Rope!

What Happens When a V-Belt Bends

Straight-Sided V-Belt

How Straight Sided V-Belt Bulges in Sheave-Groove. Sides Press **Unevenly** Against V-Pulley Causing **Extra Wear** at Point Shown By Arrows.

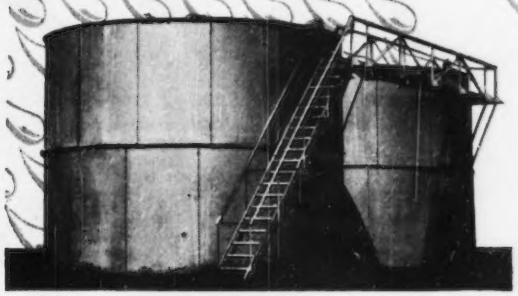
Gates Vulco Rope with Concave Side

No Side Bulge. Precise Fit in Sheave Groove. Sides Press **Evenly** Against V-Pulley—Uniform Wear—Longer Life!

CS-505

THE GATES RUBBER COMPANY
DENVER, U.S.A.
The World's Largest Makers of V-Belts

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries



Twin 500-barrel Hiboy Bolted Steel Tanks with Safwalk Walkway

ECONOMICAL STORAGE *for Your Liquids*

• On-the-site storage of Liquids is no longer a problem. BS&B Tanks can go wherever you can go. Bolted Steel or Durable Wood, when knocked down, is only a truck load. Many times they have been flown in to a new operation.

And there is much more to recommend BS&B Tanks in addition to portability. They have proved their ability in containing all types of materials. Bolted Steel are ideal for oils, water, even aviation gasoline. BS&B wood tanks are employed the world 'round for water, brines corrosive fluids and settling systems.

They're soundly engineered for long, long life. Weatherproof and tight as a bottle. Even inexperienced labor can erect them quickly. Many sizes available from stock. EXPORT SHIPMENTS A SPECIALTY.

Handsome, all-Redwood 500-barrel Durable Wood Tank

Black, Sivalls & Bryson, Inc.

Section 1-94BT

720 Delaware St. Kansas City 6, Mo.

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BS&B TANKS

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720 Delaware St. Kansas City 6, Mo.

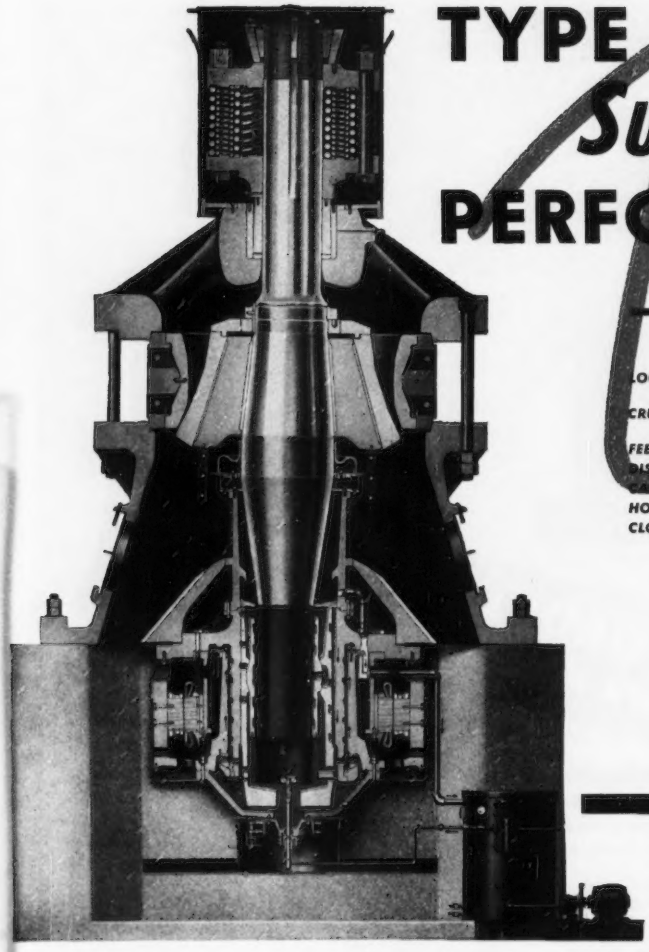
Send me full particulars concerning the use of BS&B
☐ Bolted Steel ☐ Wood Tanks. We do _____ mining.

NAME _____ TITLE _____

FIRM _____

STREET _____

CITY _____ STATE _____



TYPE "S" GIVES *SUPERIOR* PERFORMANCE

—PROOF:

YES — IT CAN BE DONE!

LOCATION: NATIONALLY KNOWN MINING CO. IN NEW YORK STATE

CRUSHERS: FOUR NO. 37½ KENNEDY TYPE "S" ROLLER BEARING GYRATORY CRUSHERS

FEED OPENING: 6¼"; *DIAMETER OF HEAD:* 3 FEET

DISCHARGE SETTING: 7/32" CLOSED SIDE AT HEAD

CAPACITY EACH CRUSHER: [illegible] TONS PER HOUR

HORSEPOWER EACH CRUSHER: 48 HP

CLOSED CIRCUIT OPERATION

GRADATION AS FOLLOWS:

THE FIGURES!

99.8%	Minus	3 MESH
93.3	"	4 "
80.6	"	6 "
66.6	"	8 "
56.1	"	10 "
48.1	"	14 "
40.6	"	20 "

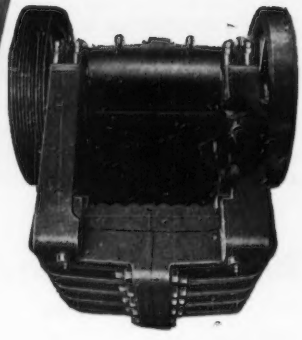
CAN YOU EQUAL THESE FIGURES?

These figures PROVE performance

the SECRET . . .

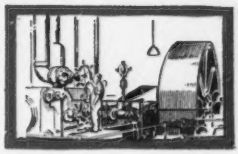
. . . *of* BETTER WORK

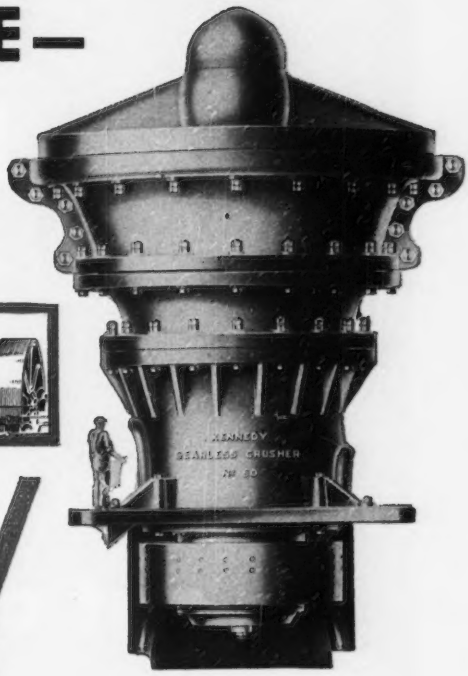
YES — "KVS" felt that Swing Jaw Crushers COULD be improved to do MORE Crushing for LESS POWER — and here's how we did it! Instead of the one SWING jaw doing ALL the work, while the stationary jaw LOAFED, we set BOTH jaws at the same angle, so BOTH jaws carry the load evenly. And that's not all — to make things simpler and stronger, we made the swing jaw ALL ONE PIECE, except the renewable crushing plate. Also, swing and stationary jaws are INTERCHANGEABLE; and also reversible end-for-end. Result — double the Crushing life before replacement. When it comes to Real PRODUCTION it's YES — "KVS!"



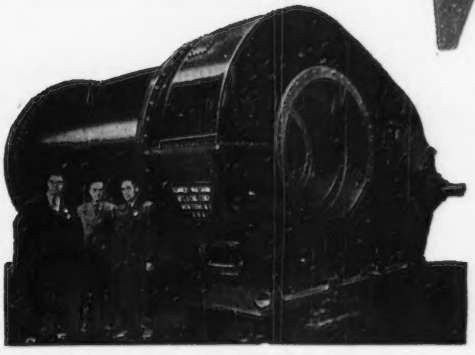
Yes—KVS means the products

CRUSH MORE—
PAY LESS—
WITH KVS





YES — "KVS" puts added FREE crushing POWER into every big "KVS" Gearless Crusher. We do it the way Mr. Corliss did it in the famous Corliss Engine. He put in a big pulley or flywheel, flying around, creating Kinetic Energy. "KVS" Gearless does it with a big whirling pulley, too. You can imagine the extra energy you get from a whirling 8-TON pulley on a 400,000 lb. "KVS" traveling 3,500 ft. a minute! What's more, having no gears, you can turn the pulley yourself with 2 fingers, so smoothly, effortlessly does it work! YES — it's "KVS" for lowcost power, and this is only ONE of the many "KVS" Gearless Crusher features.



...$6,000 *IS YOURS!*

YES — you can save up to $6,000 on a 10 ft. tube or ball mill — if you decide on a "KVS" with integral gear drive. Because then the motor can be *direct connected* to the driving shaft. The pinion shaft to which the motor is connected runs at approximately 600 r.p.m. The other pinion shafts run at about 180 r.p.m. ON A 10 FT. MILL THIS ENABLES YOU TO PURCHASE THE SYNCHRONOUS MOTOR AT A SAVING OF ABOUT $6,000. What's more, "KVS" trunnions on large sized tube and ball mills are CARRIED ON OIL. The bearing never wears out, uses little power. All gears and bearings are automatically sprayed with oil before tube mill is started (Design patented). YES — it's "KVS" for value, long life. In 15 years no "KVS" gears or pinions have worn out on this type mill.

READY FOR YOU—

YES — there are "KVS" Bulletins covering all the above products, waiting for you. Just write us for them, and YES — we'll send them promptly!

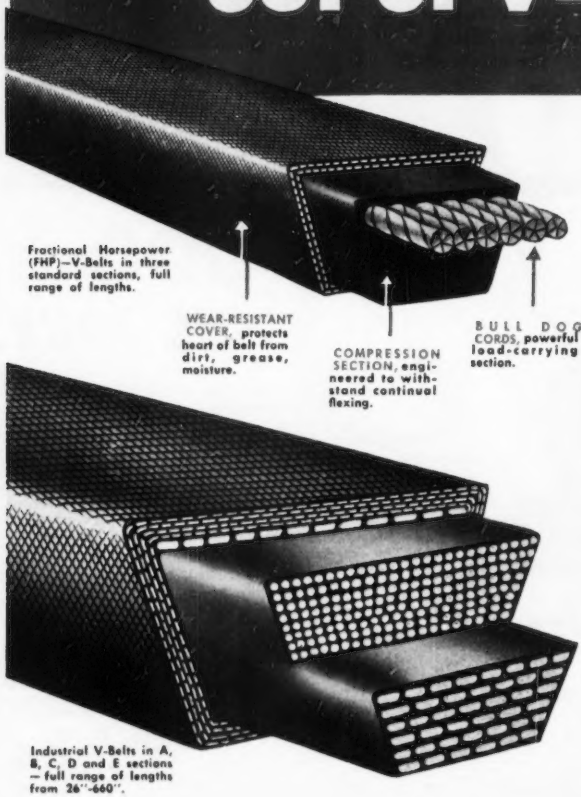
Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
2 PARK AVE., NEW YORK 16, N. Y.
FACTORIES:
DANVILLE, PA., U.S.A.
CANADA, ENGLAND, FRANCE, AUSTRALIA

without trouble—

BWH

DEPENDABLE RUGGEDNESS

BULL DOG V-BELTS demonstrate how to get the most out of V-Belts


Fractional Horsepower (FHP)—V-Belts in three standard sections, full range of lengths.
WEAR-RESISTANT COVER, protects heart of belt from dirt, grease, moisture.
COMPRESSION SECTION, engineered to withstand continual flexing.
BULL DOG CORDS, powerful load-carrying section.
Industrial V-Belts in A, B, C, D and E sections — full range of lengths from 26"-660".

OUTSTANDING ADVANTAGES OF BULL DOG V-BELTS

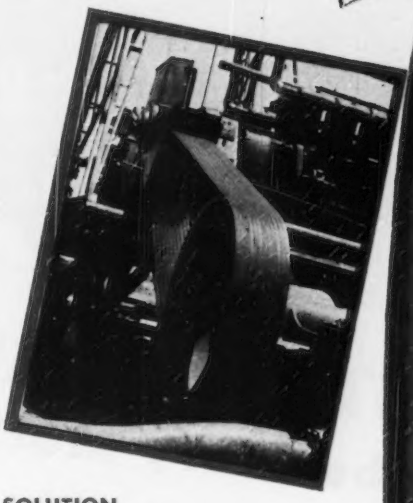
1. Fewer Maintenance Headaches. Because BULL DOG V-BELTS require less adjusting and last longer, they save time, money and worry in maintenance.

2. Longer Belt Life. Because new, quality-controlled compounds developed in BWH laboratories run cool, don't crack or deteriorate under severe flexing.

3. Backed by BWH Reputation for Extra Service. In the 72 years that BWH has been a leader in the mechanical rubber manufacturing field, BWH products have built steady fame for outstanding performance. BULL-DOG V-BELTS fully live up to BWH reputation for dependable ruggedness.

Efficient V-Belt operation insures steady, smooth, low-cost power transmission, without maintenance worries, over long periods of time. And that's exactly the kind of economical, worry-free service BULL DOG V-BELTS deliver in all types of industry.

Each job has its own problems, however. Here are some of the common ones that engineers report in V-Belt operation, with BWH solutions:



PROBLEM	SOLUTION
Excessive Cover Wear on V-Belts	Check sheaves for worn grooves. Check alignment between sheaves. Check to see that sheaves are tight on shafts.
Covers Loosen . . Rubber Gets Soft and Sticky	Check for excessive oily conditions. If contact with oil or grease cannot be prevented, then specify BULL DOG HSO V-BELTS, which are oil resistant. (Also heat resistant and static conducting.)
V-Belts Failing Within Few Hours of Installation	This is usually caused by prying V-Belts over edge of sheaves, causing internal cords to break. Correct method of installation is to move motor of driven machine until belts do not have to be forced onto sheaves. Then move motor back until sufficient tension is applied.
New V-Belt Installed As Replacement Fails, While Old Belts Continue Running	Never install a new belt in a set of old belts, because it will be either shorter or longer than the old belts. If shorter, it will be excessively overloaded and fail. If longer, it will not transmit an equal share of the load. Always install a complete new set of belts and retain old belts for an emergency, or for temporary replacement if needed.

It will pay you to investigate BULL DOG V-BELTS on your next installation. They have what it takes for smoother operation on both FHP motors and on high-powered industrial jobs.

HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems. We're specialists in solving them. Consult your nearest BWH distributor or write us direct.

FOR ALL MECHANICAL RUBBER GOODS CONSULT BWH

Established in 1878, BWH is today one of the world's largest manufacturers of mechanical rubber goods. Among the quality-famous BWH products which are today helping industry to do better jobs at lower cost are the following:

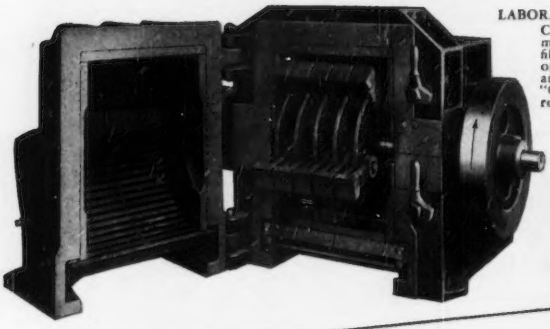
CONVEYOR BELTING
ELEVATOR BELTING
TRANSMISSION BELTING
AIR HOSE
CONTRACTORS' HOSE
FIRE HOSE
OIL INDUSTRY HOSE
STEAM HOSE
WATER HOSE
OIL FIELD SUPPLIES
FRICTION TAPE
SPLICING COMPOUND

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

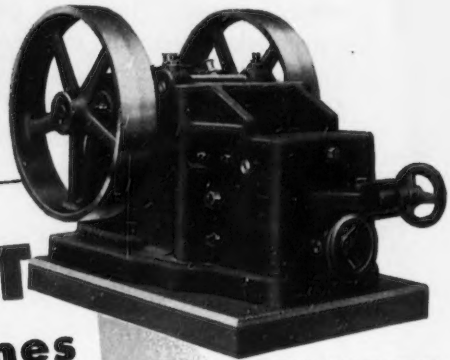
Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS., U.S.A. • P.O. BOX 1071, BOSTON 3, MASS., U.S.A.



LABORATORY SWING-SLEDGE MILLS

Capable of reducing soft, moderately hard and tough or fibrous materials to any degree of fineness between 1 in. and 20 mesh. The patented "Open-Door" feature permits ready accessibility for cleaning.



STURTEVANT

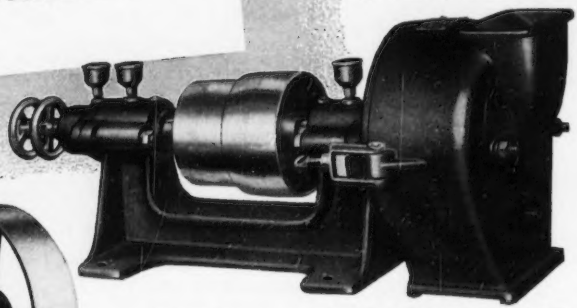
Laboratory Machines

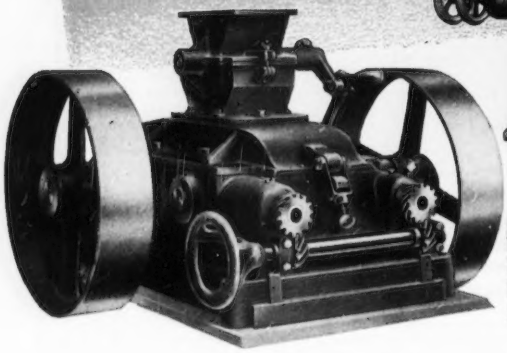
Assure Quality of Products

Fast - Economical - Accurate

LABORATORY JAW CRUSHERS

Special Roll Jaw action simplifies close regulation of the product with capacities varying from 300 or 400 lbs. per hour at finest settings, to 1000 or 2000 lbs. when opened for coarser work. Each part of the crusher is accessible for quick and easy cleaning.





LABORATORY CRUSHING ROLLS

First designed especially for laboratory sampling work, Sturtevant Crushing Rolls are used regularly in many plants where there are limited outputs. Range of output for the 8 x 5 size is from ½ in. to 20 mesh — and for the 12 x 12 size from ¾ in. to 20 mesh.

LABORATORY SAMPLE GRINDER

Laboratory Sample Grinders are of the "Open-Door" disc type and are capable of very fine work, producing products as fine as 100 mesh (coarser if desired) when working on dry, friable, soft or moderately hard materials. Simply turn hand wheel to provide product regulation from 10 to 100 mesh.

The only sure way to maintain strict quality of products is laboratory control . . . and that calls for accurate sampling.

Sturtevant Laboratory Equipment meets the exacting requirements of laboratory work. They are fast and accurate . . . provide true samples.

Rugged and dependable, Sturtevant equipment actually has all the features of full size machines plus extra accuracy and wider range of adjustment. The "Open-Door" accessibility permits quick, thorough cleaning . . . prevents the possibility of previous batches from contaminating new samples.

Investigate Sturtevant equipment for your laboratory. It will cut your sampling costs . . . help maintain strict quality of products . . . increase sales. Write for complete details and catalog.

STURTEVANT MILL COMPANY

101 CLAYTON STREET, BOSTON 22, MASS.

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS •

Thermoid Research Gives Greater Flexibility and Wear-ability to New-Type Hose!

Thermoid has designed *Thermine* Air Hose especially for more efficient and economical use in drilling operations—from construction jobs to mining.

Increased flexibility allows greater freedom of movement and permits bending the hose easily around tight corners. A heavy synthetic rubber oil-proof tube is reinforced with heavy braided rayon cord. Smooth, extra-heavy rubber cover offers maximum resistance to abrasion and cutting by sharp rocks.

Thermine Air Hose is mandrel-built from ¼" to 1½" inclusive in 50 ft. lengths. Available at your nearest Thermoid Distributor.

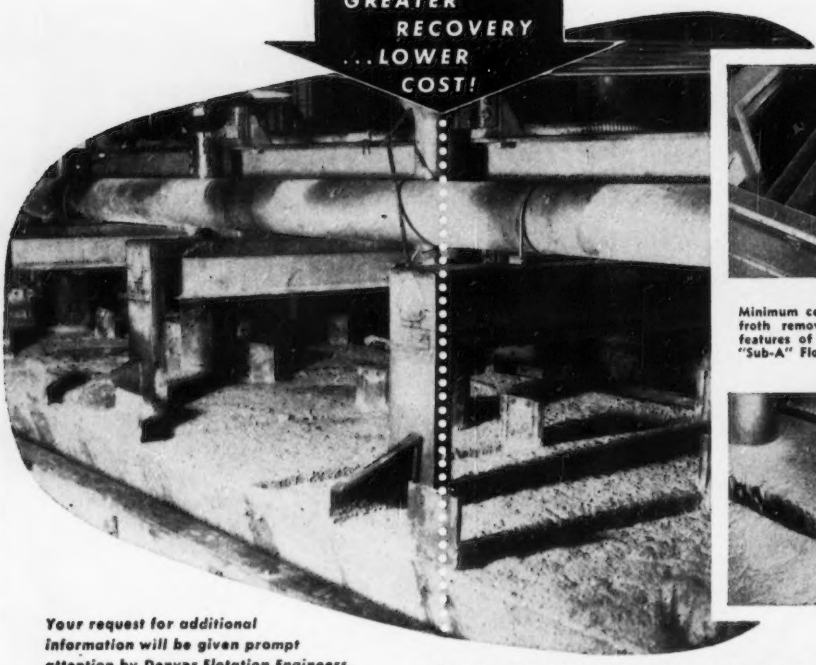
Thermoid Quality Products: Transmission Belting • F.H.P. and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Molded Products • Industrial Brake Linings and Friction Materials.

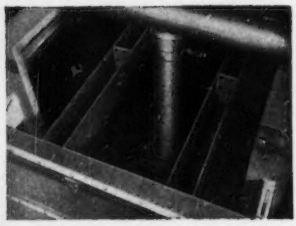
For *Complete* Satisfaction *Specify* Thermoid!

Thermoid Company

Main Offices and Factory • Trenton, N. J., U. S. A.
Western Offices and Factory • Nephi, Utah, U. S. A.
Industrial Rubber Products • Friction Materials • Oil Field Products

GREATER RECOVERY ...LOWER COST!





Minimum cell obstructions and maximum froth removing transverse launders are features of the New Denver Open Type "Sub-A" Flotation Machine.

Your request for additional information will be given prompt attention by Denver Flotation Engineers.

IN SCAVENGING AND ROUGHING WITH

New DENVER OPEN TYPE FLOTATION MACHINE

Among the Advantages:

- Lower tailings . . . higher recovery.
- Increased capacity for rougher and scavenger circuits.
- Lower Power requirements.
- Standard "Denver" wearing parts used throughout.
- Open type machine easily converted to cell-to-cell type if character of ore changes.

Among the reasons for high tailing losses on certain ores is the fact that weakly attached mineral particles never reach the froth overflow level but instead, due partly to interruption in horizontal pulp travel, drop out and are lost in the tailings. Recovery is improved in the New Denver Open Type Flotation Machine due to two distinctive developments.

Unobstructed Horizontal Pulp Flow Gives Maximum Recovery

Elimination of cell partitions and other below-froth-level obstructions in the New Denver Machine permits more mineral particles to more quickly rise to the froth level. Dropping out of weakly attached middling particles is reduced to a minimum, resulting in maximum recovery and lower tailing.

Froth Travel Reduced to One Third

Patented *Transverse Launders* running from front to back of the New Denver Open Type "Sub-A" Flotation Machine reduces froth travel to one third and increases the length of overflow lip to four times that of a single overflow machine.

This more efficient froth removal means fewer mineral particles drop out to become tailing losses. Overall capacity and efficiency of the machine are improved, particularly in treating middlings and in coarse flotation.

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

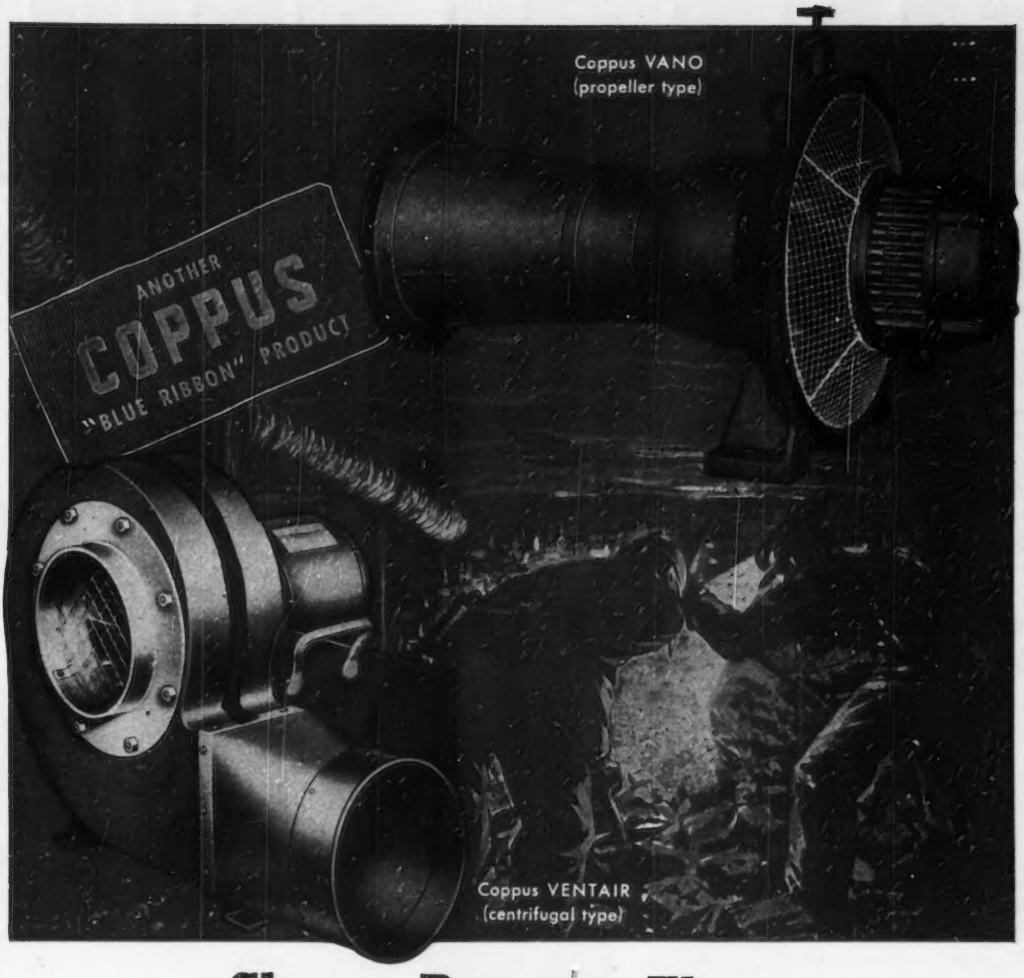
FLOTATION ENGINEERS

Complete ore dressing equipment, from testing to feeder to dryer.

"The firm that makes its friends happier, healthier and wealthier"

DENVER • NEW YORK • CHICAGO • EL PASO • VANCOUVER • TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG • RICHMOND

DENVER EQUIPMENT COMPANY, 1402 17th St., Denver 17, Colorado



Choose Between Them and Get 30% to 100% More Air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus **VENTAIR** is for long pipe lines; the propeller-type Coppus **VANO** for shorter lines . . . the correct selection will give you from ⅓ more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Massachusetts.

COPPUS ENGINEERING CORPORATION
285 Park Avenue, Worcester 2, Mass.

Please send.....Bulletin 130

Name .....

Company .....

Address .....

TANDEM DRIVE MOTOR GRADER

only **$3,585**

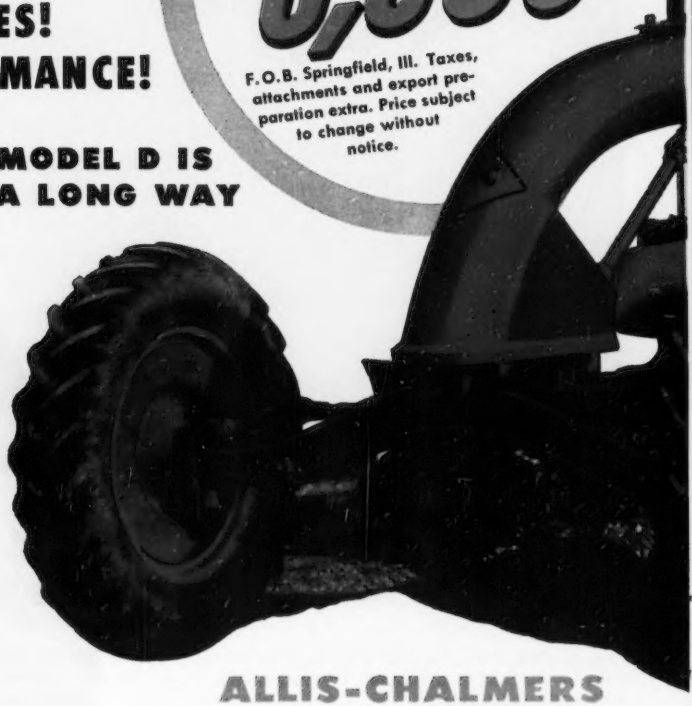
F.O.B. Springfield, Ill. Taxes, attachments and export preparation extra. Price subject to change without notice.

Here's a value that invites comparison

***Compare* THE PRICE!**
***Compare* THE FEATURES!**
***Compare* THE PERFORMANCE!**

. . . and you will agree

THE ALLIS-CHALMERS MODEL D IS YOUR BEST BUY . . . BY A LONG WAY



Not a converted job . . . it's ENGINEERED NEW FROM THE GROUND UP — to bring you BIG grader design and performance advantages:

- ✓ Tandem Drive
- ✓ Rear-Engine Design
- ✓ Tubular Frame
- ✓ High Arch-Type Front Axle
- ✓ Roll-Away Moldboard
- ✓ Drop Down Transmission
- ✓ Power Hydraulic Controls
- ✓ Full Visibility
- ✓ Complete Operator Comfort
- ✓ Simplified Servicing

. . . Plus special attachments that widen its usefulness — Rear-End Loader, Scarifier, Windrow Eliminator, "V" or Blade-Type Snowplows. Also, various other accessories. Electric starter and lights standard equipment.

"Seeing is Believing." Ask Your Allis-Chalmers Dealer for a Demonstration.

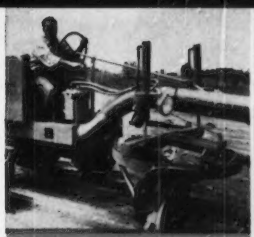
ALLIS-CHALMERS

MODEL D

WEIGHT — 8,500 lb. (bare)

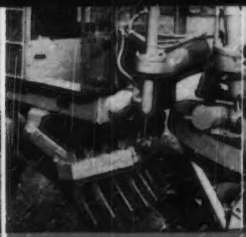
BRAKE HP. — 34.7 (famous Allis-Chalmers gasoline engine)

SPEEDS — four forward, 2.40 to 18.61 mph.; reverse to 2.9

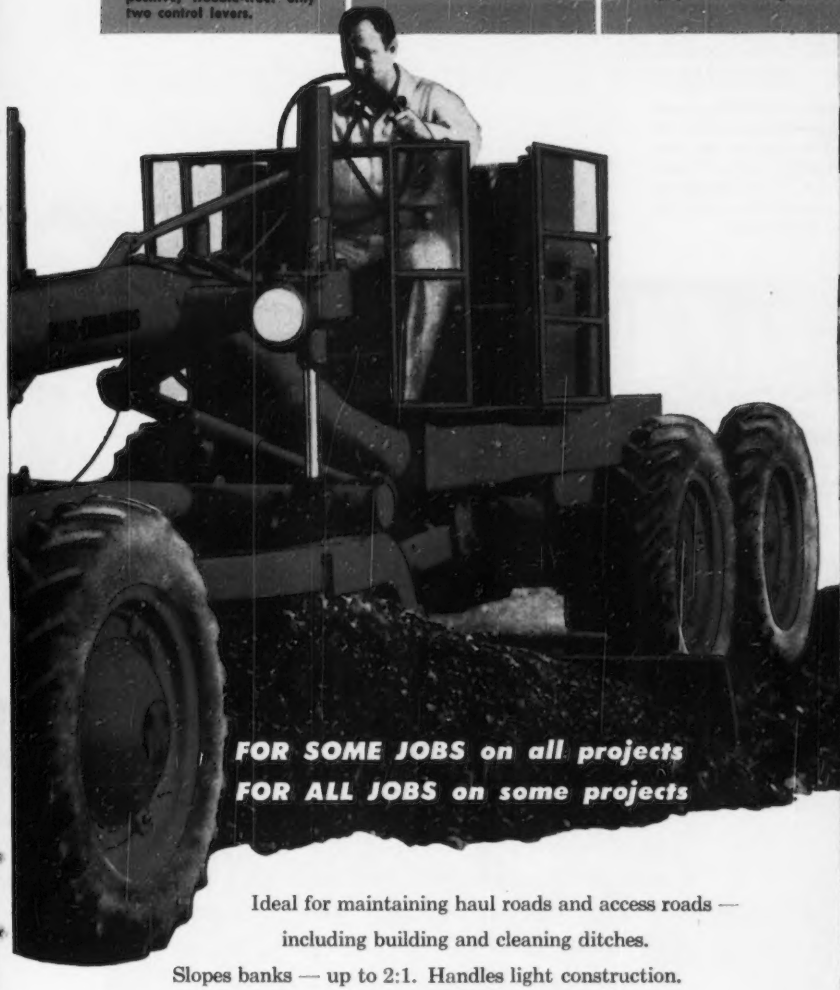


BLADE ANGLE SET FROM OPERATOR'S PLATFORM. Hydraulic blade lift—fast, positive, trouble-free: only two control levers.

ALL-VIEW CAB — quickly lifted off or replaced.



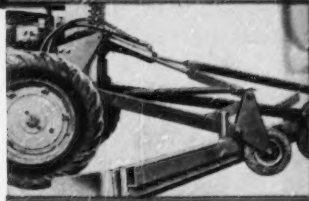
HYDRAULICALLY CONTROLLED SCARIFIER — Located back of circle for greater down pressure. Fast, accurate ripping, controlled penetration. Easy, positive steering resulting from greater front-end stability.



FOR SOME JOBS on all projects
FOR ALL JOBS on some projects

LOADS MATERIAL into trucks with [illegible] motive Loader — from windrows and stockpiles . . . surplus dirt or snow. Hydraulically operated, simple to mount 5/8 cu. yd. bucket — available with [illegible] teeth. Note carrying position of [illegible] no interference with steering or [illegible]

PLOWS SNOW with specially designed Baker snowplows — "V" or Blade-type. Hydraulically controlled. Interchangeable blade plow may be used for backfilling and light 'dozer work.



WINDROW ELIMINATOR SAVES TIME. This rear blade saves extra pass by feathering out windrow from grader blade. Means safer traffic conditions, too. Specially designed for the Model D.

Ideal for maintaining haul roads and access roads — including building and cleaning ditches.

Slopes banks — up to 2:1. Handles light construction.

Plows snow. Loads all types of materials. Scarifies.

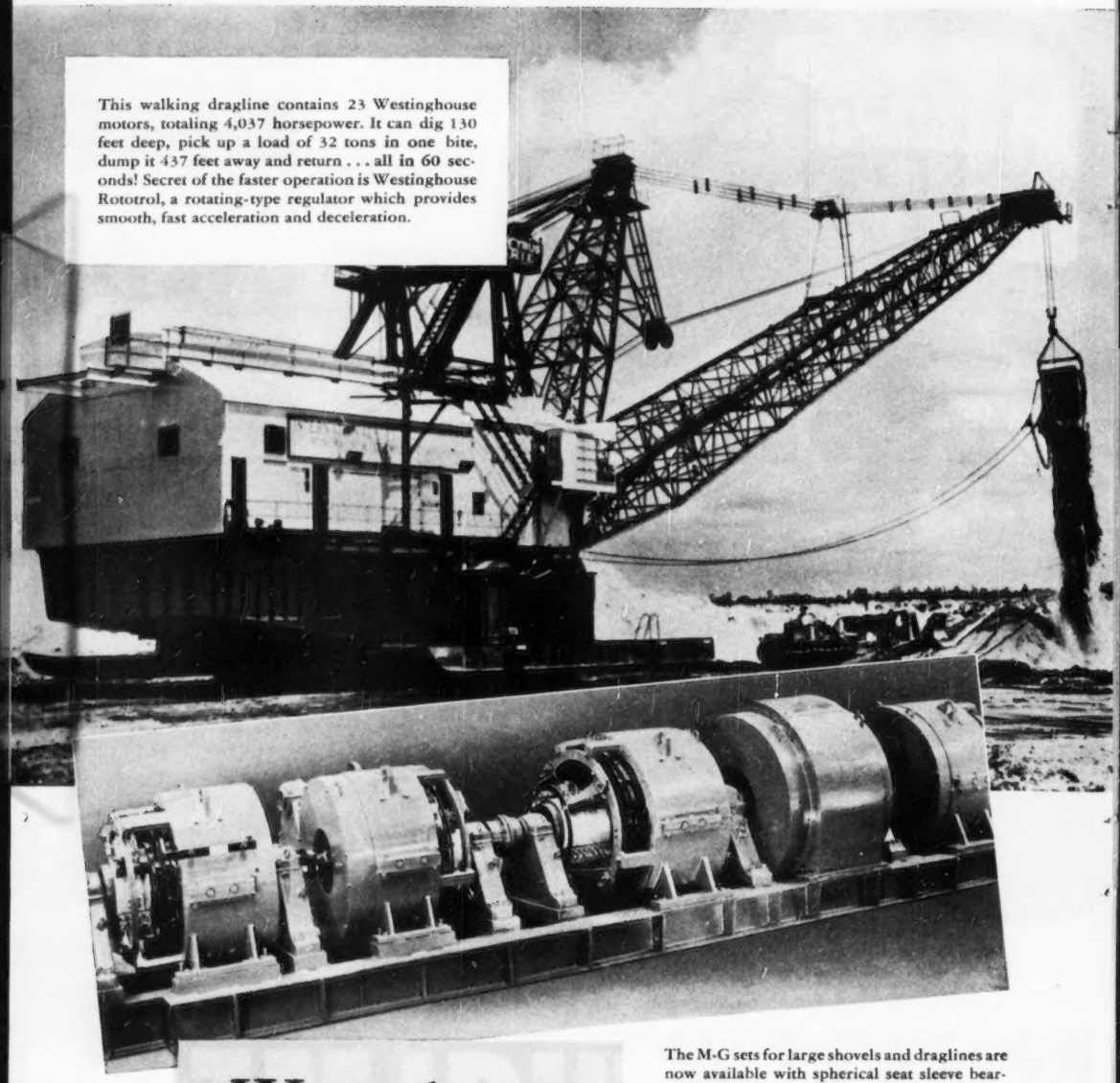
Does outstanding work on every job — the year around, at big savings.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

For Greater Production...For Easier Operation...For Simplified Servicing

YOU CAN BE SURE.. IF IT'S Westinghouse



This walking dragline contains 23 Westinghouse motors, totaling 4,037 horsepower. It can dig 130 feet deep, pick up a load of 32 tons in one bite, dump it 437 feet away and return . . . all in 60 seconds! Secret of the faster operation is Westinghouse Rototrol, a rotating-type regulator which provides smooth, fast acceleration and deceleration.

The M-G sets for large shovels and draglines are now available with spherical seat sleeve bearings. This new development compensates for misalignment and provides adequate lubrication even under severe operating conditions and tilts up to 15°.

Westinghouse

EQUIPMENT FOR THE MINING INDUSTRY

Westinghouse-equipped draglines and shovels

FOR MORE TONS PER MAN-HOUR

Some two-thirds of all large draglines in use in this country are Westinghouse equipped. Many of these are in use by operators who have again and again specified Westinghouse equipment.

For instance, one northern Illinois coal company and an associated company have purchased a total of four large draglines in the past few years. Each time Westinghouse equipment was specified. Another case is a Pennsylvania coal operator who has purchased three such draglines on all of which Westinghouse equipment was specified.

There must be reasons why Westinghouse equipment is so well liked by operators who have tried it. Here are a few of them—

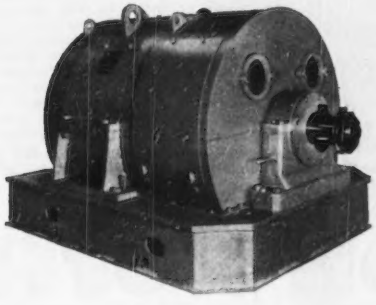
Smooth operation is brought about by Rototrol. This rotating regulator developed by Westinghouse makes possible speed changes with less strain, resulting in less maintenance and smoother operating characteristics throughout.

Fast operation comes from the higher bucket-lowering speeds of the large Westinghouse drive motors. It comes, too, from the fast swing cycle and accurate spotting of bite and drop that Rototrol makes possible.

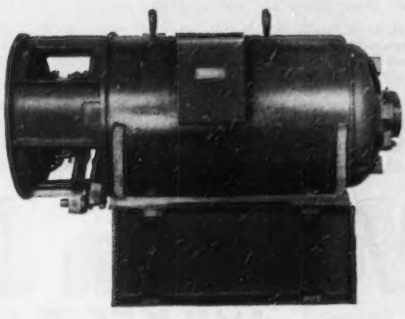
Reliable operation of Westinghouse equipment reduces down time. For example, Rototrol is the simplest of all rotating controls, both as to apparatus and circuits. The large M-G sets are equipped with spherical seat sleeve bearings designed to permit continuous operation even at tilts of up to 15°. Many of the small motors have sealed, pre-lubricated bearings that require no lubrication, and that have a *proved* record of lower maintenance.

This co-ordinated equipment for shovels and draglines is a product of the more than half a century during which Westinghouse engineers have worked with the Mining Industry. If you are interested in handling more tons per man hour, let our Mining Industry Specialists help you work out the answers. Call your nearest Westinghouse Office, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

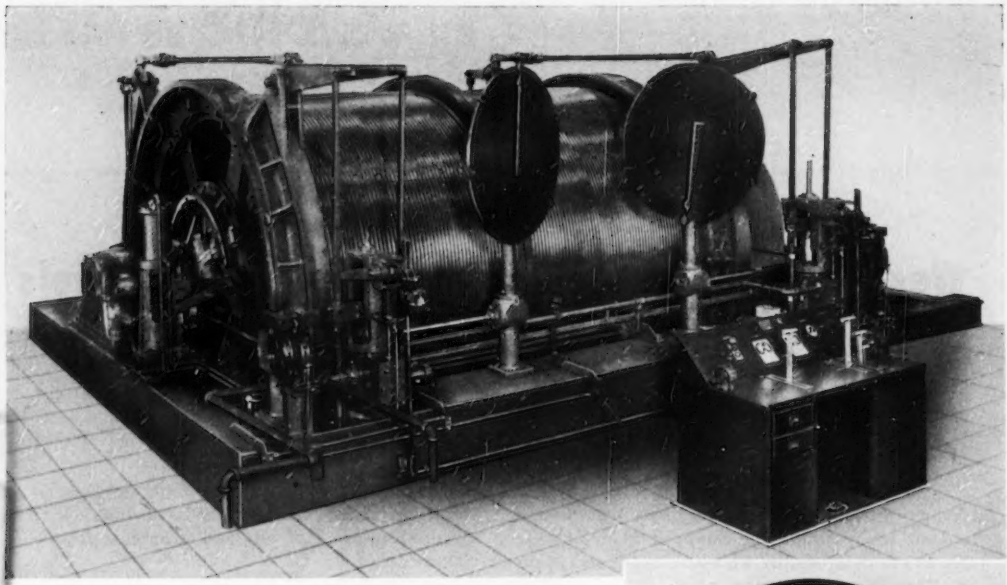
J-94809



In large drive motors such as this, the use of poleface compensated winding makes possible a smaller armature diameter and a lower WR^2. This feature is available both on the 425-hp motor and the 600-hp motor now being offered for use on shovels and draglines.



This is the Rototrol unit that has revolutionized performance of shovels and draglines. By eliminating the sharp changes and attendant strains of Magnetic Control previously used, Rototrol speeds operation and reduces maintenance costs.



Roller Bearings Minimize Friction In This Modern VULCAN Hoist

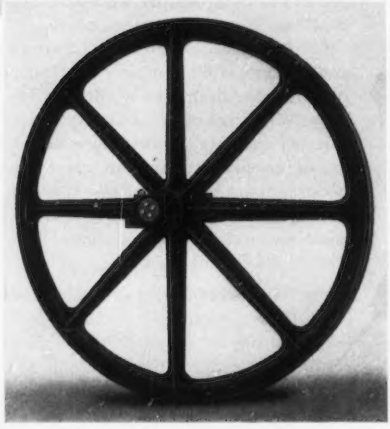
Designed and built to meet the specific requirements of a well-known metal mining company, the hoist shown above, assembled in a Vulcan shop, "has everything" to promote fast, safe, convenient operation.

When installed, it will be driven by dual 250 hp. motors through flexible couplings and single-reduction herringbone gears running in oil. The main shaft and both of the two pinion shafts are mounted in spherical-roller-bearing pillow blocks to minimize friction and assure permanently accurate alignment. All operating levers and instruments are grouped at a control desk on the floor level, providing SIMPLIFIED EFFORTLESS CONTROL.

Other modern equipment includes parallel-motion post-type brakes on each drum and a toothed-type positive clutch on one drum. Brake and clutch engines are operated by oil-hydraulic pressure. Brake and clutch on the loose drum are mechanically and electrically interlocked.

The all-steel "built-up" drums are 10'-0" diam. by 6'-2" face with machine-cut grooves for 1609 feet of 1¾" rope in one layer. Each drum is equipped with a gear-driven safety controller which provides complete protection for hoisting from several different levels.

Your operating conditions may require an entirely different type of hoist but Vulcan's experienced engineers will welcome an opportunity to submit an equally suitable design. No charge or obligation—just give us the necessary data.



VULCAN ALLCASTEEL SHEAVES
WITH ROLLER BEARINGS

were furnished for use with this hoist and for other hoists operated by the same company. The sheave here illustrated is 10 ft. pitch diam., grooved for 1¾" rope and equipped with tapered roller bearings in the hub. The "dead" shaft is held in clamp-type steel pedestals. Light, strong, true-running and so highly resistant to rope wear that NO LINERS ARE NEEDED, Vulcan Allcasteel Sheaves have proved their money-saving superiority for every type of heavy-duty service. Bulletin A-396 (20 pages, fully illustrated) gives complete information.

Vulcan Iron Works

Established 1849

WILKES-BARRE, PA., U.S.A.

Cable Address "Vulworks Wilkes-Barre"

Manufacturers, also, of Underground Conveyors and all types of Locomotives for underground and surface haulage.

an AKINS machine

TO FIT ANY CAPACITY REQUIREMENT

Large or Small

For

Closed Circuit Grinding

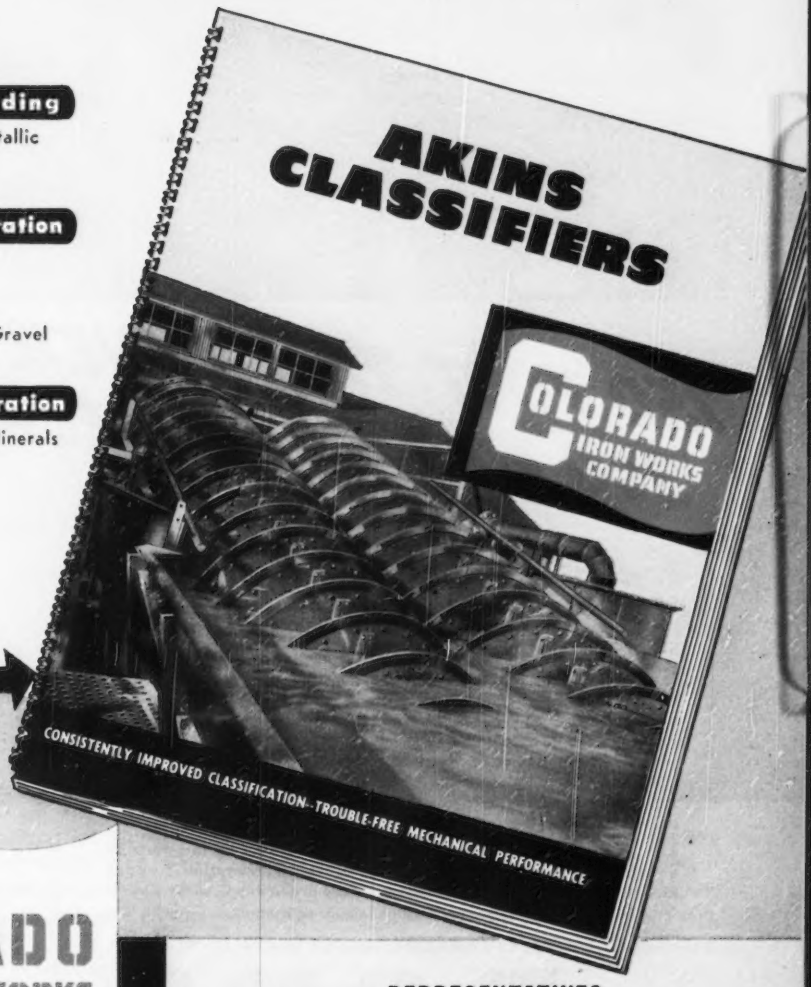
- Metallic and Non-Metallic Ores
- Cement

Washing and Concentration

- Ores
- Phosphate Rock
- Glass Sand
- Industrial Sand and Gravel
- Oyster Shell

Heavy Media Concentration

- Ores and Industrial Minerals
- Coal



JUST OFF THE PRESS

Write for Bulletin No. 48—
NO OBLIGATION

COLORADO IRON WORKS COMPANY

DENVER 2, COLORADO

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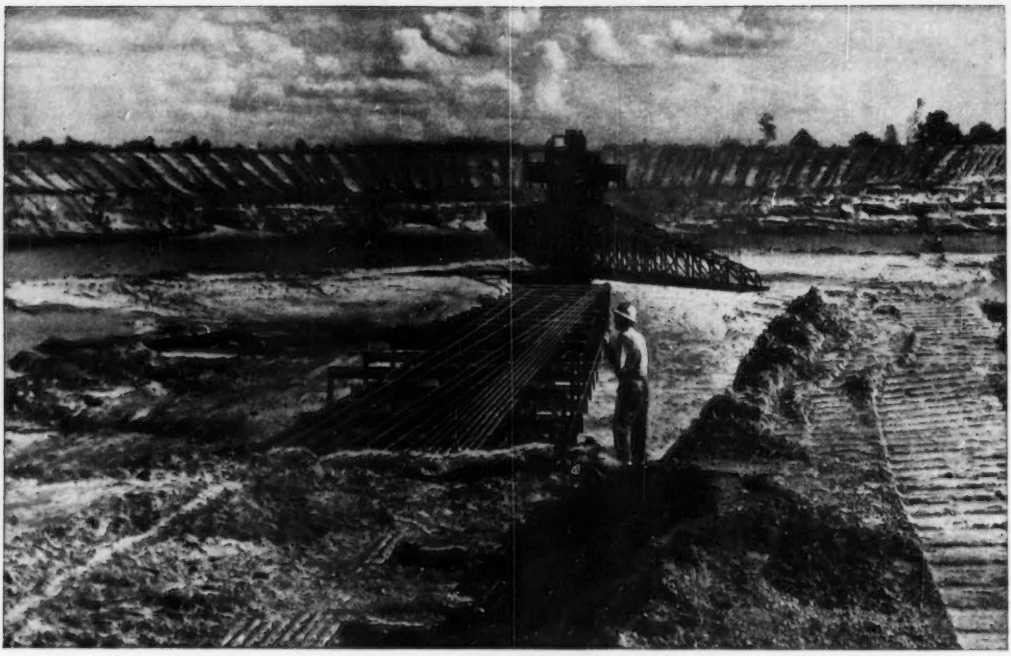

750 FOOT THICKENER 300 FOOT DORR MECHANISM

Team for economy at American Cyanamid's Sydney Mine

How to clarify 15,000 gpm of phosphate rock tailings water carrying 2% solids—on a budget? That was the problem facing the American Cyanamid Company at their Sydney Mine in 1948. Overflow had to be clear enough for reuse—underflow thick enough for practical impounding.

Our answer to the problem—based on thorough study and field testing—was the installation pictured above. A 300′ dia. special Dorr SSC Thickener mechanism, incorporating a flocculating feedwell and picket arms, installed in a 750′ dia. earthen basin with a sloped bottom. Preliminary thickening to a concentration of approximately 6% solids takes place in the outer, unswept, portion of the basin. Final thickening to 12-15% solids is effected by the mechanism in the central area.

This unusual installation—the world's largest settling basin served by a single mechanical unit—has just gone into initial operation. It is one more example of an unusual sedimentation problem solved by Dorr—the oldest manufacturer of sedimentation equipment . . . with the *newest* ideas.

Diagrammatic sketch of 300′ dia. Dorr Thickener installed in 750′ dia. earthen tank at American Cyanamid Company's Sydney Mine near Brewster, Florida.

DORRCO

THE DORR COMPANY, ENGINEERS
BARRY PLACE, STAMFORD, CONN.
NEW YORK • ATLANTA • TORONTO
CHICAGO • DENVER • LOS ANGELES
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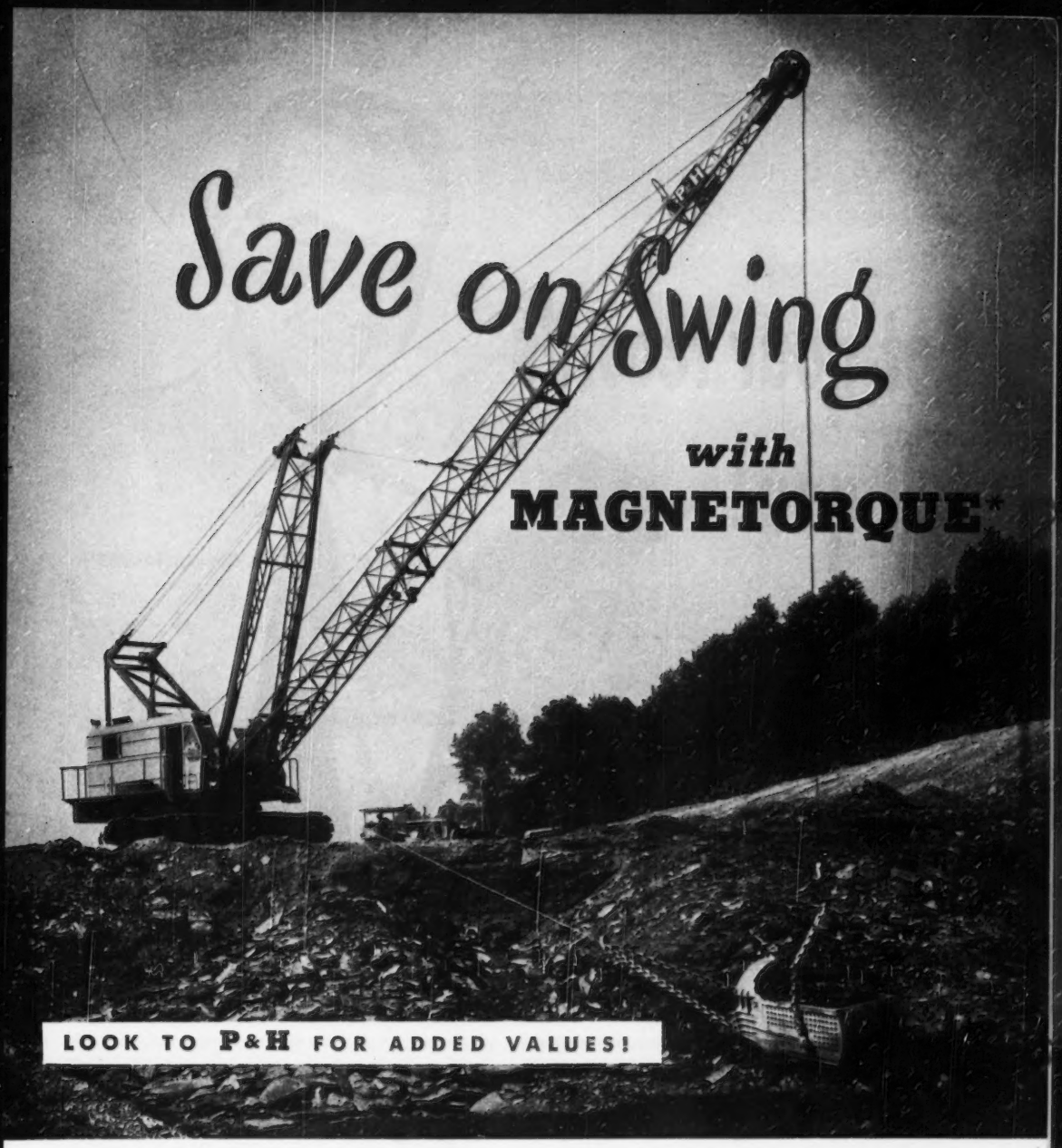
PETREE & DORR DIVISION, STAMFORD, CONN.
ASSOCIATES AND REPRESENTATIVES
Dorr Technical Services and Equipment Are Also Available Through Associated Companies and Representatives in the Principal Cities of the World. Names and Addresses on Request.

DORR

RESEARCH ENGINEERING EQUIPMENT



Faster digging cycle . . . up to 20 percent faster . . . is yours with the P&H Magnetorque* electric swing. Only Magnetorque can give you faster, smoother starts and stops that make this possible. It means greater production, lower cost, and more profits. You'll say it's the greatest advancement ever made on large draglines and shovels. You can say good-bye to swing friction troubles . . . once and for all. Power is transmitted electro-magnetically . . . there's no friction . . . there's no wear . . . and far less time-outs to rob production. The smooth operating Magnetorque lasts the life of the machine.

On all kinds of digging the Magnetorque can help you cut yardage costs. Magnetorque electric swing is standard on the P&H 1055 (3½ cu. yds.) and the new 955-A (2½ cu. yds.). Write today, for more information.

*T.M. of Harnischfeger Corporation for electro-magnetic type clutch.

P&H
EXCAVATORS
4454 W. National Avenue
Milwaukee 14, Wis.
HARNISCHFEGER
CORPORATION

EXCAVATORS • OVERHEAD CRANES • ARC WELDERS AND ELECTRODES • SOIL STABILIZERS • CRAWLERS AND TRUCK CRANES

Let your records tell you!

It's no news that the true cost of wire rope cannot be reckoned by purchase price alone. As we've so often pointed out, the real cost is the cost per unit of work it does.

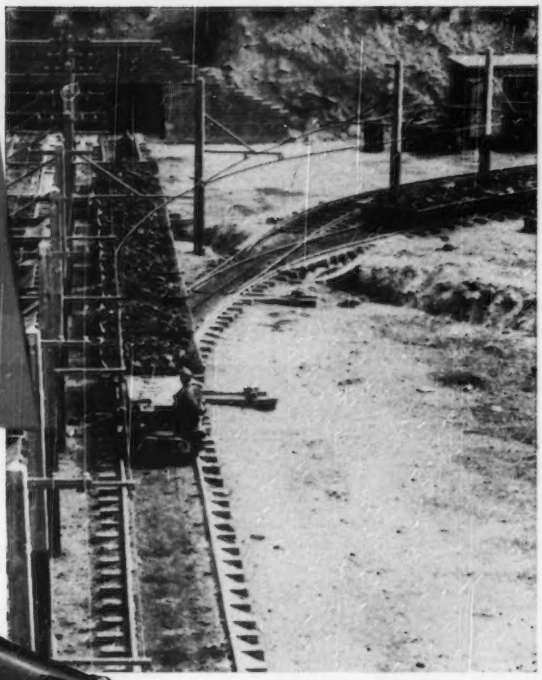
In the case of Bethlehem rope, this figure will be *low*, and you will therefore have an economical rope. But we strongly suggest that *you* prove this to your own satisfaction. Keep some simple records; something to show, for instance, the rope costs per ton-mile in oil-country drilling . . . or per car of coal hauled up a slope . . . or per cubic yard of rock moved, etc. Pick the most convenient unit of work applicable to your business. It isn't at all difficult or complicated.

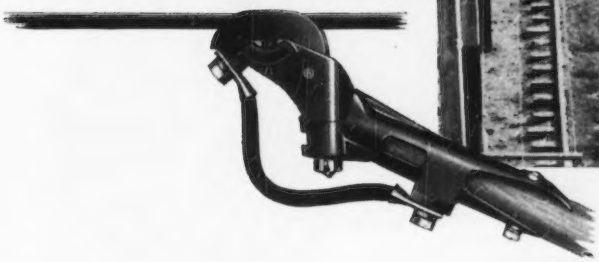
Then, study your records every so often. They'll tell you, far more convincingly than we can, that Bethlehem wire rope is an *economical* rope.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

For Heavy Duty Haulage, USE SHOES

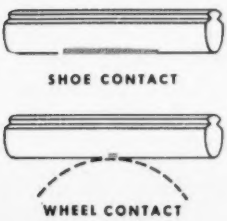




• If you want a smooth, dependable flow of power from the trolley wire to the collectors of your main haulage locomotives, use a collector that presents the largest possible area to the wire. That's why shoes—O-B Type-L Trolley Shoes—are better suited to heavy duty haulage than trolley wheels. Here's the reason: Shoes, in the first place, do present a larger surface for current transfer than the wheels. Because of this, current passing from the wire to a trolley shoe passes through what might be called a "line" contact, as contrasted to the "point" contact between the wire and a wheel. An abrupt jog in the wire will break the contact between a wheel and the wire, interrupting the power flow. When this happens, there is a good deal of arcing, for the flow of current has been concentrated through a very small area. However, the current flow is distributed through a series of points in the case of the shoe, and since the shoe is less likely to break contact with the wire, the chances for power interruption and arcing are much less. You see, the pivotal center of the shoe is located in the center line of the wearing surface, eliminating any tendency for the shoe to tilt because of friction between the shoe and the wire. Further, a jog in the wire, while depressing the leading end of the shoe, will press the trailing end more firmly against the wire. The reverse is true when the center of the shoe passes the jog.

Your O-B representative will be glad to tell you more about the advantages of shoe current collection. Ask him what it can do for you in your mines.

4055-M



Field tests show that under identical conditions of heavy electrical load, trolley shoes outlast wheels many, many times. This is because of reduced arcing and burning with the use of shoes. The sketches show the difference in surface covered by the wheel or shoe in contact with the wire.

Ohio Brass

MANSFIELD OHIO, U. S. A.

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

PROVEN DEPENDABILITY

in time of urgent need...

MINE RESCUE

M·S·A MOBILE SAFETY STATION

Effectively meeting mining requirements as rescue station, maintenance shop, traveling classroom, first aid ambulance, and field testing laboratory, this important M.S.A. development affords mobility, speed, and efficiency in service. Engineered throughout for maximum utility, M.S.A. Mobile Safety Stations are equipped with every essential for field operations, furnished to particular specifications.

Specially designed built-in cabinets, racks and compartments accommodate the equipment carried with easy accessibility. Work areas are ample and unobstructed. Typical equipment includes a wide range of mine rescue aids, dust control kits and sampling outfits, gas analysis equipment, complete first aid equipment (with adequate space provided to accommodate six stretcher patients), instruction facilities for first aid and mine safety procedure, and many other desirable additional features. Write for Bulletin BH-5.

M·S·A PNEOPHORE

A new, highly effective instrument for administering oxygen under intermittent pressure, the M.S.A. Pneophore is used for oxygen therapy in treating patients suffering from gas inhalation or shock. It is adaptable for use with any oxygen supply, and operates without suction or excessive pressure, automatically following the breathing requirements of the patient. Bulletin CV-3.

H-H INHALATOR

Used in conjunction with artificial respiration, the well-known H-H Inhalator supplies a correct mixture of oxygen-carbon dioxide to the lungs of the unconscious patient—aiding more rapid recovery from exposure to gases or electric shock. Bulletin CA-9.

EQUIPMENT by MSA

SAFETY EQUIPMENT HEADQUARTERS

McCaa TWO-HOUR OXYGEN BREATHING APPARATUS

Standard of the mining industry for long-period respiratory protection in fighting and sealing mine fires, re-establishing ventilation, and rescue work, the McCaa Two-Hour Oxygen Breathing Apparatus is compact and self-contained. Supplying complete respiratory protection for the wearer in unbreathable atmospheres for a minimum of two hours, even under hard physical exertion, the Apparatus is approved by the U. S. Bureau of Mines. The unit employs a high-pressure oxygen cylinder, and a regenerator which removes carbon dioxide from the expired breath and returns the oxygen content to the circulatory system. All parts of the circulatory system are under positive pressure, eliminating entrance of outside atmospheres. For detailed information, write for Bulletin BB-3.

M·S·A Chemox OXYGEN BREATHING APPARATUS

For respiratory protection in unbreathable air, Chemox—a self-generating oxygen breathing apparatus,—offers the advantages of lightest weight (only 13½ lbs. complete), extreme simplicity of operation, and replaceable canisters which can be stored indefinitely and are always ready for instant use. No high-pressure cylinder, valves or fittings. U. S. Bureau of Mines approved. Bulletin B-14.

M·S·A ALL-SERVICE GAS MASK

Wherever 16 per cent or more of oxygen is present in the mine atmosphere, the famous All-Service Mask provides safe respiratory protection against gases (including carbon monoxide) and smokes. Light and comfortable to wear, with quickly-adjusted All-Vision Facepiece, the Mask uses the long-lived All-Service canister, which is quickly replaceable when required. Write for Bulletin EA-8.

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS AND MEADE STREETS . . . . . PITTSBURGH 8, PA.

At Your Service: **48 BRANCH OFFICES in the UNITED STATES**

MINE SAFETY APPLIANCES CO. OF CANADA LIMITED · Toronto, Montreal, Calgary, Winnipeg, Vancouver, New Glasgow, N. S.
MINE SAFETY APPLIANCES CO. (S.A.) (PTY.) LTD. · Johannesburg, South Africa; N'Dola, No. Rhodesia; Bulawayo, So. Rhodesia

Representatives in Principal Cities in Mexico, Central and South America CABLE ADDRESS: "MINSAF" PITTSBURGH

[redacted] MINING COMPANY

TEST DATA

DEPARTMENT Mill

OBJECT of TEST -- Now operating 86 Marcy Ball Mill as overflow. Mine now increasing output. Check grate discharge to see if we can handle more tonnage. Do not coarsen the grind. Run tests for 1 month each.

OPERATING CONDITIONS

As Overflow: 8'-6"×6' ball mill; 21 RPM; 77.5% Critical Speed; Closed Circuit; 11114 Tons/month = 380 Tons/day; Classifier Overflow: 4.9% +48 Mesh, 14.1% +65, 15.8% +100, 29.1% +200, 10.5% +300, 25.6% -300

As Grate: Same mill size & speed. Flow sheet same. 12836 Tons/month = 465 Tons/day. Classifier overflow: 3.9% +48 Mesh; 11.6% +65; 16.6% +100; 28.1% +200; 5.0% +300; 34.8% -300

SUMMARY	Overflow	Grate			REMARKS
Ball Mill Size	8'6"×6'	8'6"×6'	.....	.....	Same Size
Tons/24 hours	380	465	.....	Increase	of about 22.3%
KWH/ton	11.78	9.62	.....	Power drop	of about 18.3%
Grind	4.9% +48	3.9% +48	.....	Finer grind	- better for recovery
Ball Wear/ton	2.04#	1.87#	.....	Steel consumption	dropped

Test proves that Marcy Grates will give us at least 22% more tonnage and save us 18% in power along with a reduction in ball consumption. Flotation section prefers the finer grind.

[redacted]
Mill Superintendent

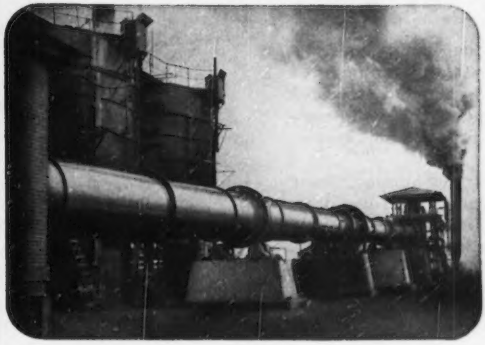
OTHER PRODUCTS

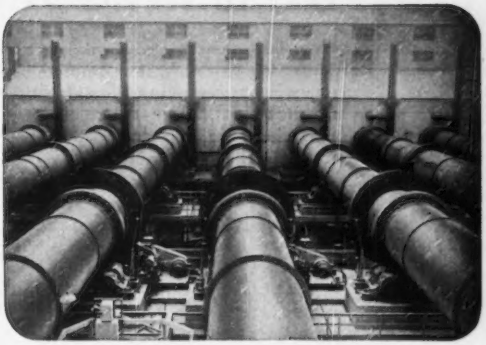
Massco Fahrenwald Flotation Machines; Genuine Wilfley Tables; Massco-McCarthy Hot Millers; Rock Bit Grinders; Density Controllers; Belt Feeders; Pinch Valves; Assay and Laboratory Supplies and Equipment; Complete Milling Plants; Constam Ski Lifts.

Main Office: DENVER, COLORADO, U.S.A.; El Paso; Salt Lake City; 1775 Broadway, New York, N.Y.; Canadian Vickers, Ltd., Montreal; W. R. Judson, Santiago and Lima; The Edward J. Nell Co., Manila, P. I.; The Ore & Chemical Corp., 80 Broad St., New York 4, N.Y., Representatives for Continental Europe.

THE Mine & Smelter SUPPLY COMPANY

Individual Engineering is the Hallmark of Traylor Rotary Kilns





Contributing to the outstanding performance of Traylor Kilns is the careful survey of each proposed installation and the subsequent designing of a kiln "tailor-made" to fit the individual requirements of the job it must do. Because this policy brings Traylor customers back again and again, many of the kilns we build today will work side by side with Traylor Kilns which are veterans. Many of these re-orders are part of expansion programs made possible by the profitable operation of Traylor Kilns.

The battery of seven Traylor Kilns is owned by a company that operates many other Traylor installations. The long list of Traylor users includes names that are by-words of industry . . . companies that attained their success while operating Traylor equipment.

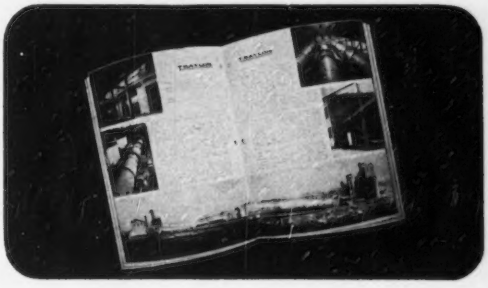
Here Are The Features That Bring Old Customers Back To Traylor

ALL-WELDED STEEL SHELLS. The shells of Traylor kilns are made of thick steel plates welded together to obtain single section rigidity. Reinforcing rings strengthen all circumferential joints.

TURNED AND FACED RIDING RINGS. Riding rings on Traylor kilns are turned and faced to a true, smooth finish. They are attached to the shells without bolts or rivets.

IMPROVED SUPPORTS. Kiln alignment is easily maintained by specially designed supports. One support on each kiln is equipped with tapered thrust rollers.

CUT STEEL GEARS AND PINIONS. All driving gears and main pinions are precision cut from suitable steel on our Maag Gear Generator. Gears are reversible for extra service.



The superiority of design, construction and operation of Traylor Kilns, Coolers and Dryers is set forth fully in illustrated Bulletin 115. Write for your copy today and learn the advantages of profit making Traylor equipment.

Traylor

Rotary Kilns, Coolers and Dryers
Grinding Mills . Crushing Rolls
Jaw, Reduction and Gyratory Crushers

TRAYLOR ENGINEERING & MANUFACTURING CO.
148 Mill St., Allentown, Pa.

Sales Offices: New York, N. Y., Chicago, Ill., Los Angeles, Calif.
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

A "TRAYLOR" LEADS TO GREATER PROFITS

Better piping for every job from a single source...CRANE

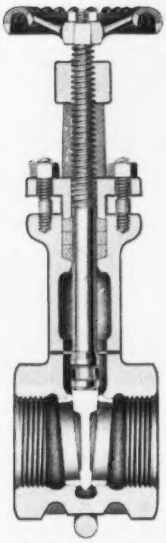
EASY-TO-SERVICE VALVES FOR MINES

Note how easy it is to dismantle these Crane Clamp Gates. By loosening two nuts, the complete bonnet assembly can be lifted out without removing the valve body from the line. Repeated opening does not affect bonnet joint tightness. Unusually compact, these brass trimmed valves are ideal for all common services in and around mines.

For heavy fluid service and on lines subject to gumming, Crane recommends all-iron inside screw clamp gates. Improved free-draining bonnet prevents entrapment of line fluids. Specially designed bonnet threads have wiping action on stem screw, which prevents sticking.

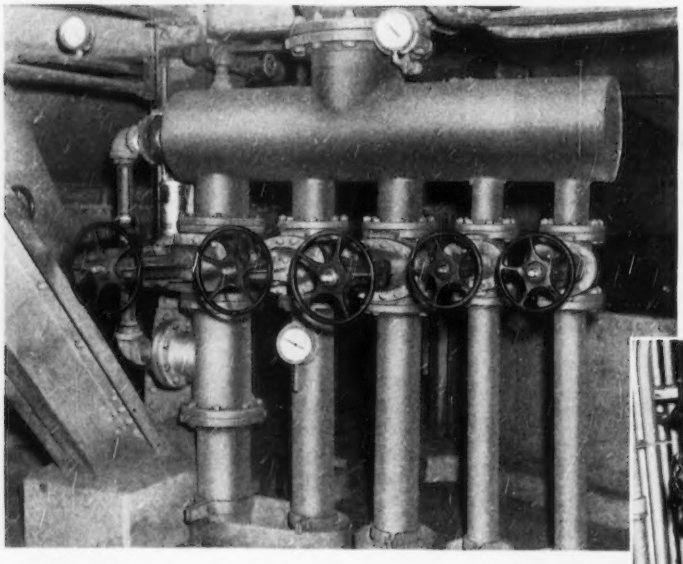
Crane Clamp Gates are available in patterns for every need: Inside Screw, O. S. & Y., and Quick-Opening. Choice of flanged or screwed ends. See your No. 49 Crane Catalog, or send for Folder AD-1667.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



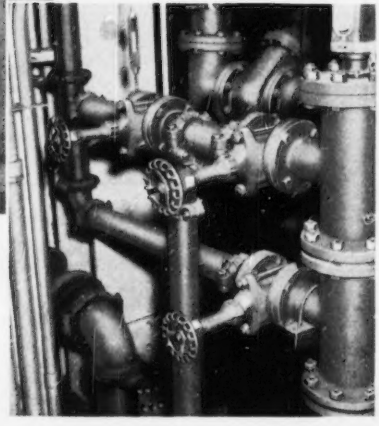
No. 486½, Screwed Clamp Gate. Working Pressures: up to 150 pounds saturated steam; 225 pounds water, oil, gas. Sizes: ½ to 4-in.

● ***ONE ORDER TO CRANE CAN COMPLETELY EQUIP ANY MINE PIPING INSTALLATION***



MANIFOLD TO PEA AND BUCK CONE *in breaker plant; also to agitator rings and classifier. Crane supplies all piping materials for installations of this kind.*

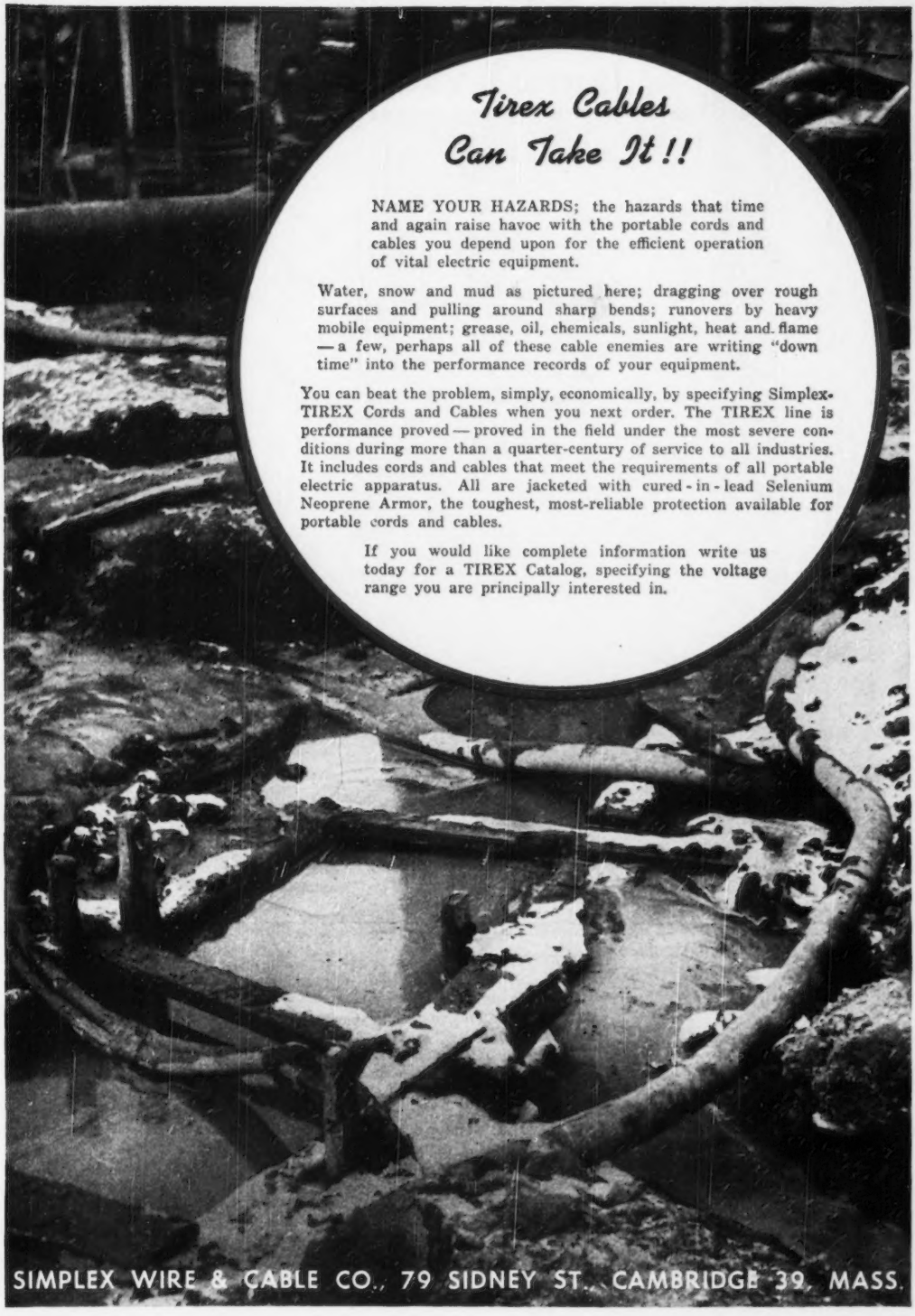
ROTO-SLEEVE BY-PASS *equipped with Crane brass trimmed clamp gate valves.*



EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING


Tirex Cables
Can Take It!!
NAME YOUR HAZARDS; the hazards that time and again raise havoc with the portable cords and cables you depend upon for the efficient operation of vital electric equipment.
Water, snow and mud as pictured here; dragging over rough surfaces and pulling around sharp bends; runovers by heavy mobile equipment; grease, oil, chemicals, sunlight, heat and flame — a few, perhaps all of these cable enemies are writing "down time" into the performance records of your equipment.
You can beat the problem, simply, economically, by specifying Simplex-TIREX Cords and Cables when you next order. The TIREX line is performance proved — proved in the field under the most severe conditions during more than a quarter-century of service to all industries. It includes cords and cables that meet the requirements of all portable electric apparatus. All are jacketed with cured-in-lead Selenium Neoprene Armor, the toughest, most-reliable protection available for portable cords and cables.
If you would like complete information write us today for a TIREX Catalog, specifying the voltage range you are principally interested in.
SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

In strip mining, for shovel hoist and draglines, Roebling Preformed "Blue Center" Wire Rope with Independent Wire Rope Core is outstanding for small and medium size equipment . . . often preferred for 20- to 40-yard machines.

For rope research and developments that help you save...

Today it's Roebling!

YEAR BY YEAR, industry makes new and more stringent demands upon wire rope . . . and Roebling leads in developing types that meet these demands with utmost efficiency and economy.

Take Roebling Preformed "Blue Center" Wire Rope with Independent Wire Rope Core!

No finer rope has ever been made, and its basis is "Blue Center" steel—an exclusive Roebling development. Its high resistance to abrasion, shock and fatigue spells long life . . . To this, Roebling *Preforming* brings the further advantages of new handling ease and improved performance . . . And the addition of I.W.R.C. assures top resistance to operating pressures and provides increased rope strength.

Roebling makes a wire rope of the right construction, grade and size for every type and make of rope-rigged equipment. Have your Roebling Field Man recommend the best rope for low-cost performance on each of your installations.

ROEBLING

A CENTURY OF CONFIDENCE

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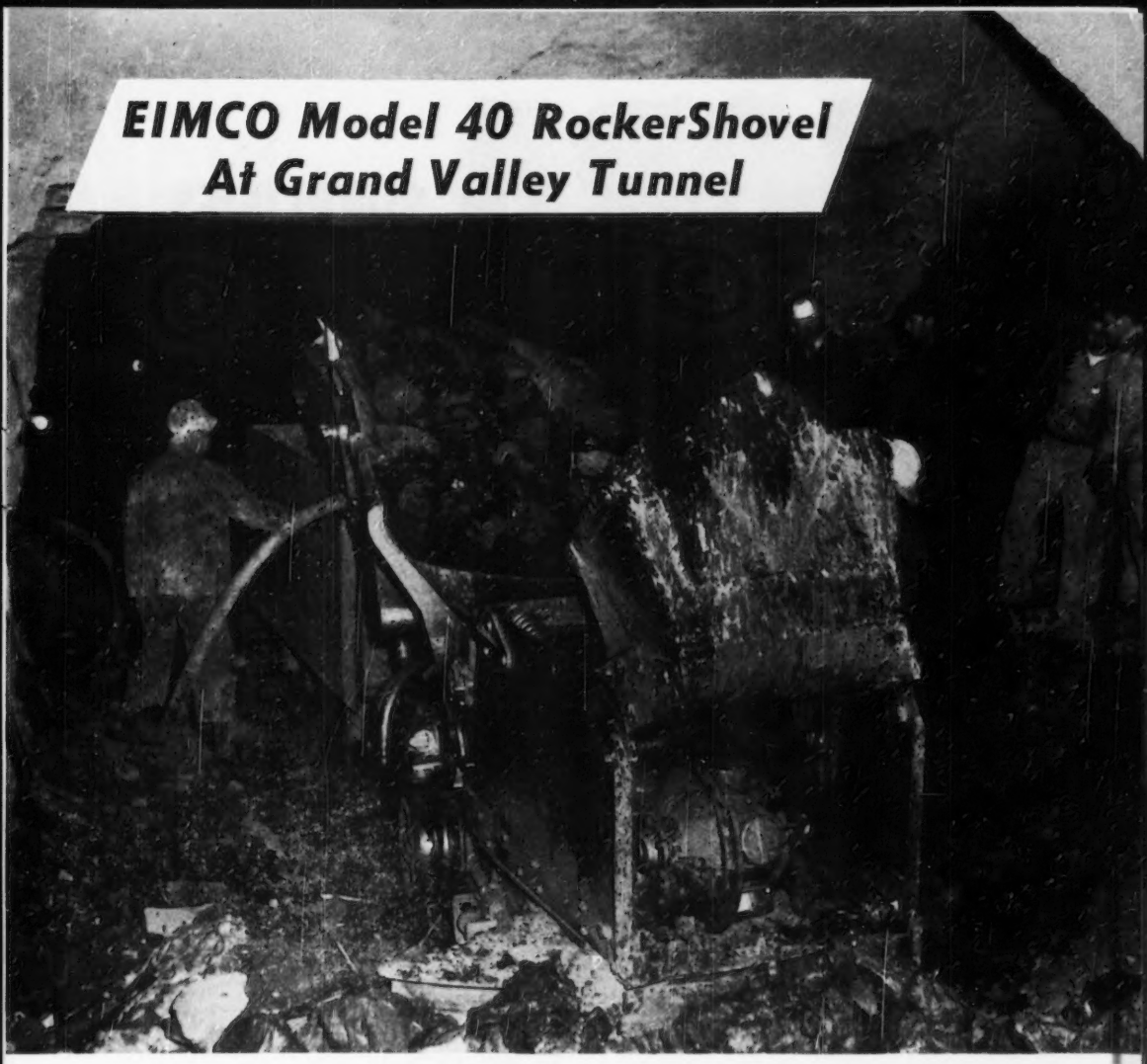
JOHN A. ROEBLING'S SONS COMPANY, TRENTON 2, NEW JERSEY

EIMCO Model 40 RockerShovel At Grand Valley Tunnel



When the Grand Valley tunnel was crushed and Grafe-Callahan Construction Co. was given a limited time to complete the by-pass tunnel they chose dependable Eimco Model 40 RockerShovels to muck out the broken rock.

The Model 40 is a fast, rugged machine—built to withstand the toughest loading and stay on the job in round-the-clock operation. Loading at the rate of 5 tons per minute the Model 40 makes short work of loading out at the face.

Eimco Model 40 RockerShovels are working both ends of this 2280 ft. by-pass tunnel.

RockerShovels are preferred equipment in every mining district of the world. There is a RockerShovel to fit your loading needs — underground or on the surface.

Write for more information.

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 8, UTAH, U. S. A.

BRANCHES: NEW YORK, CHICAGO, BIRMINGHAM, EL PASO, BERKELEY, DULUTH

AFFILIATED COMPANIES: SOCIETE EIMCO, PARIS, FRANCE

EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND

AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

You can't beat an EIMCO!

UNOBA SIMPLIFIES LUBRICATION

Mine operators save time and money with the multi-purpose grease that resists both heat and water

Multi-purpose UNOBA grease has *proved* itself with mining and mill superintendents operating under the most *critical* conditions. For example, one mill superintendent now uses heavy UNOBA exclusively on an 18″ x 36″ Type-H Traylor jaw crusher.

This company* formerly used brick grease but couldn't regulate the amount used. However, with multi-purpose UNOBA any desired amount can now be fed by increasing the depth of the grease over the bearing . . . reducing wear to a minimum.

**Name available upon request.*

Just what is UNOBA? Union Oil's exclusive UNOBA is a *barium* base grease that resists *both* heat and water. It sticks to metal surfaces with a tenacity that boiling water can't break! And it gives thorough protection at temperatures from below freezing to over 300° F.

Because of this flexibility, UNOBA *simplifies* lubrication. It performs on jobs formerly requiring *many* different types, grades and brands of grease. This results in reduced inventories, smaller storage space, less chance of using the wrong lubricant, and lower maintenance costs to you.

For *full* information, call your local Union Oil Representative, or write Sales Department, Union Oil Company, Los Angeles 17, California.

76 UNION OIL COMPANY OF CALIFORNIA

Now...Available in Larger Sizes!

HYDROCONE* (Type R) CRUSHERS

***The term "Type R" by which these Allis-Chalmers crushers have been known has been changed to *"Hydrocone."* "Hydro" denotes the use of a static liquid, such as oil, used in the *Hydrocone* crusher for supporting and adjusting the height of the crushing cone. The principle of operation has not been changed.**

TO MEET new requirements for fine crushing in a larger range of capacities, Allis-Chalmers offers the expanded line of *Hydrocone* crushers, in sizes up to 1784 (17-in. receiving opening; 84-in. diameter cone) with coarse, intermediate or fine crushing chambers.

In the *Hydrocone* design the crusher's main shaft is raised or lowered hydraulically (push-button operation on the larger sizes) permitting quick, accurate product size adjustment without stopping the crusher. An Automatic Reset device lowers the entire crushing head hydraulically to pass uncrushable materials.

- Wobble plate feeder distributes feed evenly — standard equipment for crushers with fine crushing chambers.
- Spiral bevel gears, anti-friction bearings and improved clean oil lubrication. Smooth operation; long life!
- Simplicity of design reduces maintenance costs substantially.

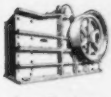
Get the complete facts about *Hydrocone* crushers — in sizes 122 to 1784 — from the Allis-Chalmers representative in your area. A-2933

IT PAYS TO SPECIFY MOTORS... CONTROLS... V-BELT DRIVES — ALL FROM ALLIS-CHALMERS

Motors — Controls

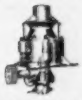
Texrope Drives

Vibrating Screens



Jaw Crushers

Kilns, Coolers, Dryers



Gyratory Crushers

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

Texrope and *Hydrocone* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

Sales offices in principal cities in the U. S. A. — Distributors throughout the world.

LONGER LIFTS. The high tensile strength of "Cordura" Rayon eliminates costly transfer points. For example, a belt reinforced with seven plies of "Cordura" can lift 1000 tons of overburden per hour up a 15° slope over 1000-foot centers. It has design tension of 900 pounds per inch of width.

POINTS TO CONSIDER BEFORE YOU BUY YOUR NEXT CONVEYOR BELT

Shown on this page are some of the reasons why more and more economy-minded operators are planning to have their next conveyor belt built on Du Pont Cordura* High Tenacity Rayon.

"Cordura" has so much extra strength over natural fibers previously used that it provides a thinner yet stronger belt . . . at no extra cost.

You may already know "Cordura" Rayon as the yarn that makes tougher truck tires, stronger high-pressure hose and longer-lasting V-belts. We'll be glad to send you the names of suppliers of conveyor belts improved with this industrial rayon.

You can also get full information about "Cordura" in the new manual, "Sinews for Industry." It gives physical properties of "Cordura" rayon, describes many successful applications and tells how "Cordura" improves the efficiency of conveyor systems. For your free copy, address Room 4529, Rayon Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

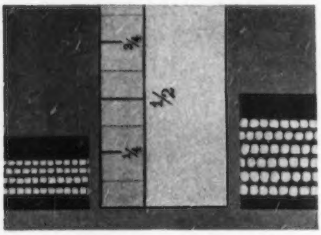
Reg. U. S. Pat. Off.

DU PONT "CORDURA" HIGH TENACITY RAYON

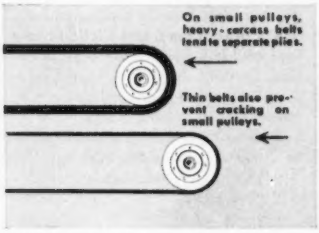
DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

for RAYON . . . for NYLON . . . for fibers to come look to DU PONT



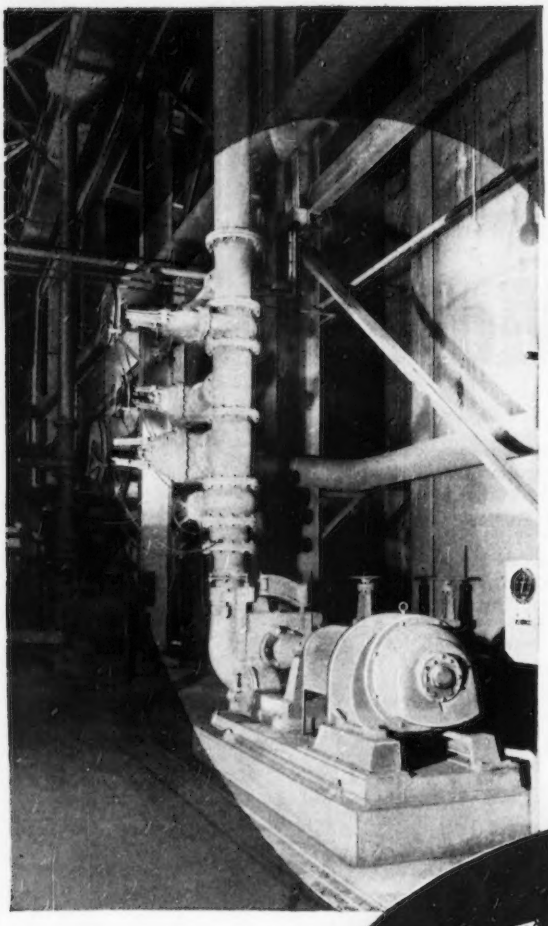
GREATER STRENGTH of belts built with "Cordura" is illustrated above. At left is cross-section of four-ply belt sinewed with "Cordura." It's stronger than conventional 6-ply belt at right, yet only half as thick. This thin, light belt is particularly desirable where panel equipment is moved frequently.



MORE FLEXIBLE. Belts built with "Cordura" have less tendency to crack and separate plies when run over small pulleys required in confined working space. And belts built with "Cordura" have less stretch, so less take-up room is needed. And they trough well under any loading conditions.

HEAVIER LOADING is possible on conveyor belts built with Du Pont "Cordura" High Tenacity Rayon. This yarn is inherently stronger than the natural fibers commonly used. It packs extra strength into conveyor belts and enables them to carry loads to the capacity of power equipment.

Move More Ore
BUCYRUS ERIE
. . . As leading mine operators everywhere do—choose Bucyrus-Erie excavators for the important ore-leading assignment. They know the speed, economy, and dependability of these ore-eaters brings them greater output with substantial cost-savings. Your Bucyrus-Erie distributor will show you why you can get better production in your pit with a Bucyrus-Erie.
See your Bucyrus-Erie distributor for full information on Bucyrus-Erie gas, diesel and single motor electric ⅜ to 4 yard excavators.
228E50
BUCYRUS-ERIE COMPANY · South Milwaukee, Wisconsin

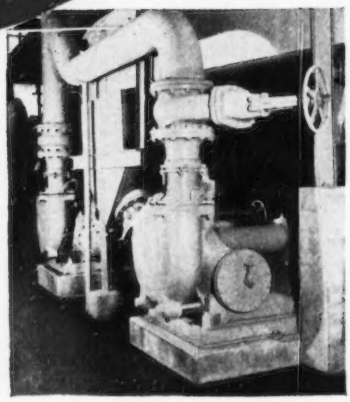


Companion to the famous WILFLEY Acid Pump

cement slurry

In every plant where slurries, sands or slimes must be handled on a cost-reducing basis, WILFLEY sand pumps can meet every requirement with a comfortable margin of reserve capacity. These famous pumps deliver continuous, trouble-free performance without attention ...stepped-up production...actual dollar-savings in power and operation. There is an economical WILFLEY pump size for every pumping problem. Individual engineering on every application. Write or wire for complete details.

WILFLEY centrifugal PUMPS



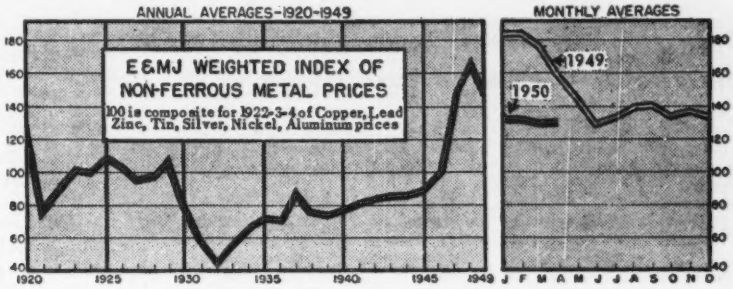
At one of America's foremost cement plants, the 8 inch WILFLEY Slurry Pumps (illustrated) deliver cement slurry continuously at maximum pumpable density, with substantial power savings and minimum replacement of wear parts.

Buy Wilfley for Cost-Saving Performance

A. R. WILFLEY & SONS, Inc. Denver, Colo., U. S. A.
NEW YORK OFFICE: 1775 BROADWAY, NEW YORK CITY

E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES-1920-1949
E&MJ WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is composite for 1922-3-4 of Copper, Lead Zinc, Tin, Silver, Nickel, Aluminum prices
MONTHLY AVERAGES
1949
1950
J F M A M J J A S O N D

MARKETS

Business looks good for metal mining right on through the second quarter, with the automotive, television, and construction industries pacing the demand. April's moderate price increases left unchecked a strong buying movement in non-ferrous metals. The E & M J price index for April rose to 134.04 from the March level of 132.60.

Demand for lead outweighed the pressure of foreign metal, and the price inched up to 11c. Uncertainty over the **copper tariff** had fabricators building up inventories. The copper market was still strong after a rise of 1c. to 19½c. With custom smelters still **hungry for zinc concentrates,** a higher price and increased mine output seemed inevitable.

LABOR

Mining will face a serious shortage of hard rock miners before long. Widely-advertised appeals for experienced miners brought few takers to one company recently. There aren't enough young men learning the job.

Mine, Mill won that sawmill election after all. (*Outlook,* April, 1950). It faces a tougher antagonist in its coming battles with Steel.

AT HOME

Uranium Notes: Climax will build a uranium-vanadium mill near Grand Junction, Colo., jointly with Minerals Engineering Co., the group Blair Burwell heads. **Sunshine Mining Co's.** pitchblende vein is looking better. **A mild uranium rush** is building up at Boulder, Mont.

The new mine subsidy bill (H.R. 8234) might pass the House, but its chances of enactment this session are pretty slim. The bill drops the administrative board planned by S. 2105, instead plumps all responsibility for subsidy control into the lap of the Secretary of the Interior.

The new mines and plants planned for the **Carlsbad potash district** by **Duval-Texas Sulphur Co.** and **Southwest Potash Corp.** (American Metal Co. subsidiary), will open up about 1,500 new jobs in that area.

American Zinc just paid $1,080,000 cash to the RFC for the Illinois zinc plants built in wartime for the RFC and run by American Zinc. The company will spend another $500,000 refurbishing them.

The outlook's not good for the attempts to revive the RFC's mining loan authority. In fact, some Senators want to kill the RFC altogether.

ABROAD

Tin producers, despite U. S. opposition, have asked the United Nations to set up a tin control agreement, which would establish a world-wide "ever-normal granary" for tin. It would fix prices, balance production and use.

Chile's president, Sr. Gonzalez Videla, seemed satisfied with his visit, last month, to the U. S. A. He obtained a wage increase for Chuquicamata's employees, probably some reassurance on the copper tariff.

MARKETS—Trends and Prices

Rising Price Levels Fails to Check Demand for Major Non-Ferrous Metals—Copper, Lead and Zinc Higher

GENERAL IMPROVEMENT in business continued throughout April. Demand for major non-ferrous metals exceeded expectations and buyers appeared to be less price conscious than at any time since last summer. Wage agreements concluded recently all favored the workers and resulted in generally higher costs. Those who expected the inflationary pressures to moderate were forced to revise their estimates. During the last month higher prices were named for copper, lead, zinc and tin. Aluminum was unchanged.

The E & MJ price index advanced to 134.04 in April, and compares with 132.60 in March and 160.86 in April a year ago. Monthly variations in our index, going back to the beginning of 1948, were as follows (100 equals the composite for 1922-3-4):

	1948	1949	1950
January	154.20	185.52	135.86
February	155.63	185.75	135.65
March	155.63	179.31	132.60
April	160.67	160.86	134.04
May	161.33	148.05	.....
June	162.30	131.20	.....
July	164.55	136.65	.....
August	177.68	141.90	.....
September	178.26	142.24	.....
October	179.58	137.81	.....
November	185.26	138.18	.....
December	185.52	136.18	.....

The Federal Reserve Board's index of industrial activity for March was 186% of the 1935-39 average, or two points above its preliminary estimate. From present indications April will be as high or slightly higher than March.

Heavy demands for copper, along with a steady shrinkage in stocks in the hands of domestic producers, finally resulted in a higher market. Rumors that the price would rise have been making the rounds of the trade for months. However, when Anaconda announced on April 18 that it advanced its selling basis to 19½c., a rise of 1c., few in the industry were prepared to accept the news. Uncertainty over the status of the import duty and rising costs were factors in lifting the quotation. Reimposition of the duty (2c. per pound) could easily bring about a higher price for copper, consumers argued, and much of the recent activity may have been inspired by price considerations. The Government favors the suspension of the duty for at least another year.

Deliveries of refined copper to domestic consumers in March increased to 123,030 tons, a new high for the movement. In addition, the stockpile probably got 16,000 tons in March. Stocks of refined copper in the hands of producers in this country dropped from 77,472 tons at the end of February to 60,276 tons at the end of March. Statistically, nearly all observers admit, the market remains in a strong position.

Fabricators' shipments to customers in March fell short of their intake by 16,386 tons, pointing to an accumulation of copper for inventory purposes. Producers' deliveries of refined copper and copper contained in products shipped by fabricators, beginning with last September, in tons, were as follows:

	Producers' Deliveries	Fabricators' Shipments
September	103,115	114,760
October	108,192	106,928
November	117,133	107,965
December	107,662	88,437
January	111,668	108,921
February	112,773	102,896
March	123,030	106,644
Totals	783,573	731,551

Stocks of refined copper in the hands of fabricators at the end of March amounted to 381,107 tons, against 363,924 tons a month previous and 387,871 tons a year ago.

Production at Anaconda's mine at Chuquicamata resumed April 10, pending settlement of the wage dispute. Later the mine workers were granted a "bonus" of 5 pesos a day.

The foreign market for copper advanced to 19½c. per pound, f.a.s. New York equivalent, effective April 19. Foreign demands on the whole were moderate.

Lead Advances to 11c., N. Y.

The firm situation in copper and zinc brought lead buyers into the market for substantial tonnages. This activity confirmed the views of producers that consumers must have been reducing their inventories to a dangerously low level during the period of price unsettlement in lead. Shortly after the price of copper rose, the call for lead was such that sellers had a "waiting list of buyers" for the first time in months. Sales in the first week in April totaled less than 6,000 tons, whereas in the final week of the month the volume increased to more than 22,000 tons. All classes of consumers participated in the buying movement. The price was raised one-quarter cent per pound on two occasions, which established the market, beginning with April 26, at 11c. per pound, New York.

A disturbing factor, so far as taking a long range position on prices is concerned, is the extent to which stockpile buying will continue to influence the price structure. Most observers believe that stockpile purchases of lead in the next year will be on a reduced scale.

Total U.S. consumption of lead (primary and secondary) was estimated at 76,337 tons in January, against 66,598 tons in December, the Bureau of Mines reports. Imports of primary pig lead in February amounted to 30,926 tons. Refineries in this country produced 41,670 tons of lead in February.

Zinc Also at 11c.

Consumers were interested in obtaining zinc in quantity for delivery to the end of June. Galvanizers were particularly active, but die casters also absorbed large tonnages. The strike at Chrysler was offset by increased production of automobiles at other plants.

The statistics for slab zinc were strong. Stocks in the hands of producers dropped to 59,776 tons at the end of March, which compares with 94,221 tons at the beginning of the year. Total shipments amounted to 85,589 tons in March. Production was estimated 77,946 tons.

Average Prices for April (E&MJ Quotations)

Copper:	
Electrolytic, Domestic, Refinery	18.640
Electrolytic, Export, Refinery	18.825
Lead:	
Common, New York	10.630
Common, St. Louis	10.428
Silver and Sterling Exchange:	
Silver, New York, per oz.	71.750
Silver, London, pence per oz.	63.000
Sterling Exchange, "Checks"	279.750
Zinc:	
Prime Western, East St. Louis	10.664
Tin:	
New York, Straits	76.430
New York, 99% min.	(e)75.430
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$71.000
Antimony, (E&MJ) (d)	27.780
Antimony, bulk, Laredo	24.500
Antimony, in cases, Laredo	25.000
Platinum, refined, per oz.	$66.000
Cadmium, (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	17.000
Magnesium, ingot	20.500
Nickel (f)	40.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange, checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotation.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot packed in cases, f.o.b. New York.

(e) Tin contained.

(f) F. o. b. Port Colborne, U. S. duty included.

As the month ended the price of Prime Western appeard to be firmly established at 11c. per pound, East St. Louis, a net gain for the month of three-quarters of a cent. Smelters fear that a possible shortage in the supply of zinc concentrate may restrict production of metal in the second half of the year. However, the price of metal now at 11c., mine output of zinc is likely to increase.

Though there were no developments during the month in reference to the international control plan for tin, prices ruled firm in this market, particularly in spot and prompt metal. Arrivals in the "free" market were light during the month, owing to reduced shipments from the Far East by private traders earlier in the year. The shortage eased toward the end of April.

Offerings of foreign silver were absorbed on the basis of 71¾c. an ounce troy, unchanged for the month. The Bank of Mexico continued to support its home market by liberal purchases.

Antimony metal was unsettled, but the leading interest maintained its quotation on the basis of 24½c. per pound, in bulk, carload lots, f.o.b. Laredo, Texas.

Manganese ore was firm and in excellent demand, reflecting the high rate of activity in the steel industry. Steel production ended the month with operations slightly in excess of 100% of capacity.

(Continued on page 103)

Major Metals

U. S. DAILY AND AVERAGE PRICES

April 1950	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	No Market	18.425	74.750	10.500	10.300	10.250
3	18.200	18.425	74.250	10.500	10.300	10.350
4	18.200	18.425	74.750	10.500	10.300	10.500
5	18.200	18.425	75.375	10.500	10.300	10.500
6	18.200	18.425	76.000	10.500	10.300	10.500
7	18.200	18.425	76.000	10.500	10.300	10.500
8	No Market	18.425	76.000	10.500	10.300	10.500
10	18.200	18.425	76.000	10.500	10.300	10.500
11	18.200	18.425	76.250	10.500	10.300	10.500
12	18.200	18.425	76.500	10.500	10.300	10.500
13	18.200	18.425	76.500	10.500	10.300	10.500
14	18.200	18.425	76.750	10.500	10.300	10.500
15	No Market	18.425	76.875	10.500	10.300	10.500
17	18.200	18.425	77.500	10.500	10.300	10.500
18	19.000	18.425	76.750	10.500	10.300	10.500
19	19.200	19.425	77.000	10.500	10.300	10.725
20	19.200	19.425	77.500	10.750	10.500	10.775
21	19.200	19.425	77.500	10.750	10.550	11.000
22	No Market	19.425	77.500	10.750	10.550	11.000
24	19.200	19.425	77.000	10.750	10.550	11.000
25	19.200	19.425	76.750	10.750	10.550	11.000
26	19.200	19.425	76.750	11.000	10.800	11.000
27	19.200	19.425	76.500	11.000	10.800	11.000
28	19.200	19.425	77.000	11.000	10.800	11.000
29	No Market	19.425	77.000	11.000	10.800	11.000
AVERAGES FOR MONTH						
April	18.640	18.825	76.430	10.630	10.428	10.664
AVERAGES FOR WEEK						
April						
5	18.200	18.425	74.875	10.500	10.300	10.350
12	18.200	18.425	76.125	10.500	10.300	10.500
19	18.560	18.592	76.896	10.500	10.300	10.538
26	19.200	19.425	77.167	10.792	10.583	10.963
CALENDAR WEEK AVERAGES						
April						
1	18.200	18.425	75.729	10.500	10.300	10.242
8	18.200	18.425	75.396	10.500	10.300	10.475
15	18.200	18.425	76.479	10.500	10.300	10.500
22	19.060	19.092	77.292	10.625	10.417	10.750
29	19.200	19.425	76.833	10.917	10.717	11.000

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

April 1950	Sterling Exchange "Checks"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
1	(c)	(c)	(c)	(c)	$35.00
3	279.750	71.750	63d.	248s.	35.00
4	279.750	71.750	63d.	248s.	35.00
5	279.750	71.750	63d.	248s.	35.00
6	279.750	71.750	63d.	248s.	35.00
7	279.750	71.750	Holiday	Holiday	35.00
8	(c)	(c)	(c)	(c)	35.00
10	279.750	71.750	Holiday	Holiday	35.00
11	279.750	71.750	63d.	248s.	35.00
12	279.750	71.750	63d.	248s.	35.00
13	279.750	71.750	63d.	248s.	35.00
14	279.750	71.750	63d.	248s.	35.00
15	(c)	(c)	(c)	(c)	35.00
17	279.750	71.750	63d.	248s.	35.00
18	279.750	71.750	63d.	248s.	35.00
19	279.750	71.750	63d.	248s.	35.00
20	279.750	71.750	63d.	248s.	35.00
21	279.750	71.750	63d.	248s.	35.00
22	(c)	(c)	(c)	(c)	35.00
24	279.750	71.750	63d.	248s.	35.00
25	279.750	71.750	63d.	248s.	35.00
26	279.750	71.750	63d.	248s.	35.00
27	279.750	71.750	63d.	248s.	35.00
28	279.750	71.750	63d.	248s.	35.00
29	(c)	(c)	(c)	(c)	35.00
MONTHLY AVERAGES					
April	279.750	71.750	63.000d.	—	35.00
AVERAGES FOR WEEK					
April					
5	279.750	71.750	—	—	—
12	279.750	71.750	—	—	—
19	279.750	71.750	—	—	—
26	279.750	71.750	—	—	—

Calendar week averages, New York Silver: April 1st, 72.550; 8th, 71.750; 15th, 71.750; 22nd, 71.750; 29th, 71.750.

(c) *No market* (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.500c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West command a premium of 1.10c. per pound over the current market for the Prime Western; Special High Grade 1.25c.

Quotations for lead are for common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and one-eighth cent fractions per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering, and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines...

G. P. Lutjen

» **"Cycle Planning in Rock Headings Means More Footage Per Day,"** which begins on page 72, really started in a blackout at Noranda in 1946. A stray cyclone, scuttling the local power system, turned out to be the proverbial ill wind when an E&MJ editor bumped into **Ray Jenkins** in the Stygian darkness of the hotel lobby. Talk turned to mining technology and the idea for an article on mining cycles was born.

Mr. Jenkins and the editor resumed their conversation in brighter circumstances at Cananea, Mexico, in 1948. Thereafter the idea received further cultivation at various mining meetings all around the U. S. until the story blossomed forth in this issue.

Getting the most out of your mining equipment is Mr. Jenkins' business. He has an amazing amount of practical data at his fingertips as operating men everywhere who know him will testify. But why say more? You can see for yourself.

» **We hope you are taking advantage** of the addressed, doesn't-need-a-stamp post card (opposite p. 126 this issue) to get more information on items in the New Products Digest. We hope you are not one of the four or five clients who each month thoughtfully circle the little numbers and thoughtlessly omit their names and addresses. Which reminds us of a story.

Two fellows hired a boat to go fishing. They found a wonderful spot. Caught a big mess of bass. "Better mark this place," one told the other, "so that we can find it again."

Later as they were driving home that evening, happy as only successful fishermen can be, the first man said, "Let's fish there again next Saturday. I hope you marked the spot well."

"Sure did! I put a great big X on the side of the boat."

"You dope!" screamed his friend. "How do you know we'll be able to get the same boat?"

The moral of this story, if any, is that nameless and addressless mining men are extremely difficult to get information to.

» **After recent bitter experience,** we are not going to stick our necks out, so we'll just say it's *probable* that the tungsten dredging operation discussed on page 82 is the only one of its kind. Unique, we believe, is the word.

Author **W. A. Noon** started in the dredging business in Oregon's John Day Valley with an old time wooden boat in the early 30's. He graduated to the Elk City district, Idaho, but operations there were shut down by the gold restriction order at the beginning of the war.

"The only way to continue making a living with a dredge," writes Mr. Noon, "seemed to be to combine something else with gold production, so the writer in his capacity of Field Engineer investigated the possibilities of placer tungsten which was at that time a necessary strategic metal."

So here he is dredging scheelite in this issue.

Incidentally, Mr. Noon's hobby is a FREE "Gold, Gold Ore and Mineral Exhibit." Should you find yourself traveling on transcontinental Highway 10, near Bearmouth, Montana, do drop in. Open to the public at all times.

» **Another item on the unusual side** is a report on one of the world's two ozokerite deposits, and the only one in the U. S. Ozokerite, as hardly anybody knows, is an essential ingredient of typewriter ribbon. The world's other ozokerite deposit is deep in the heart of the Soviet—unfortunately.

Of additional interest is the illustration for this story (p. 91). Indicates a healthy trend in the technical illustration business.

» **Well, another shipping season** is opening on the Lakes, and to mark the occasion we have included a nice looking spread of pictures (pp. 86, 87). Apparently of equal importance to many Americans was the opening of the baseball season. As self-appointed Sports Editor of E&MJ, we suggested a group picture of the Brooklyn Dodgers for this month's cover. The idea didn't get to first base.

» **The Salem (Oregon) Chamber of Commerce** reports that it received a letter from a North Weymouth (Mass.) man, saying:

"Would you please send me some information about gold mines in your state. . . . I would be very pleased if you could send me a bit of gold, too."

So would we, for that matter.

» **You'll want to check**...cost cutting Operating Ideas for making ladders (p. 106)...Keeping Tab's report on diesel haulage underground (p. 102)...a liquid that changes into a solid and back to a liquid instantaneously, for use in a novel clutch (p. 123) ...a quick look at the Roan Antelope mine.

» **Opposing recent pessimistic utterances** on the value of the Labrador iron ore deposits, **W. C. Durrell** undertakes a brief on behalf of the St. Lawrence seaway. As the man who was largely responsible for the building of the great airport at Goose Bay (handled a large portion of trans-Atlantic transportation during the war), Mr. Durrell knows whereof he speaks.

» **Those who shoulder the burden** of mine ventilation, and who doesn't, will be interested in the work of **Stephan Boshkov** and **Burton Amontree** in the field of anemometry (p. 100).

The gadgetry involved in making the necessary measurements in ventilation studies always seems to intrigue the miner. In the Coeur d'Alene district, for instance, the engineer invading the drifts with (1) high and low speed pinwheel anemometer, (2) sling psychrometer, (3) stop watch, (4) extension bar, (5) barometer, and (6) smoke gun, has been termed a "one-man scientific hell-on-ice arctic expedition."

ENGINEERING AND MINING JOURNAL

MAY, 1950

The Tax Program—A Basis for Unity

THE FAILURE OF the O'Mahoney mine incentive payment bill, S.2105, has been a source of satisfaction for some, and bitter disappointment for others, according to their positions for or against such legislation. However, nobody who has the welfare of the mining industry at heart can be elated at the spectacle of the mining industry being torn apart by controversy. It is time to unite on a constructive issue. The six-point tax program of the National Minerals Advisory Council (E&MJ, March, pp. 56-59) is the only issue within view on which the industry can unite for the common good.

The mining industry, being essential, strategically important, and geographically dispersed, can be politically effective, but only when united. It is not large enough to be able to afford being split by controversy if it wishes to have a hand in determining its own destiny. No real friend of it will knowingly lend himself to tearing it apart.

Those who were disappointed by the fate of the O'Mahoney bill will find in the tax program a sound basis for accomplishing some of the objectives they seek. To say that they have no interest because they have no profits is begging the question. They would not be trying to carry on except for the hope of future profit; thus, they have a stake in the tax picture, whether from the future profit viewpoint or the viewpoint of interesting capital in the enterprise.

The opponents of the O'Mahoney bill will find in the tax program not only a means of helping themselves and the industry out of a serious predicament, but a sound basis for joining forces with their erstwhile adversaries in a constructive movement, and thus restoring harmony within the industry. We know that many of them are personally sympathetic to the plight of small and marginal operators and will welcome an acceptable opportunity to demonstrate their good will.

Let us then, one and all, throw ourselves into this constructive program so vital to the future well-being of mining. Write to your members of Congress in your own words endorsing the six-point program, and do what you can to get others to do the same.

Breathing Spell Needed on Tariff Reductions

A REMARKABLE STATEMENT on tariff was made at Des Moines on April 7. The speaker was William E. Knox, president of Westinghouse Electric International Co. Mr. Knox counseled against further tariff reductions at this time.

This statement is of particular note because it comes from a man engaged in foreign trade. Foreign traders have been the most enthusiastic advocates of tariff reductions in the past. Mr. Knox has been in foreign trade for twenty-five years.

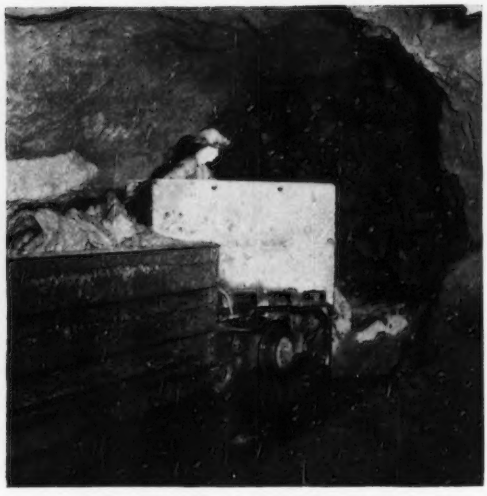
He obviously fears that the State Department is so zealous in its efforts to lower tariffs that it does not drive good bargains requiring other countries to make concessions equivalent to ours and does not insist that these countries live up to the spirit of the reciprocal trade pacts.

"Before we change our set-up," he stated, "we should wait a little while and take a second look.

"Unless I misread the signs, an international trade war is in the making and the choice of weapons which may be used includes devaluation, discriminatory tariffs, quotas, barter agreements, subsidies, state monopolies, embargoes and currency controls.

"If you do not believe the situation is changing rapidly, in fact has already changed substantially, please investigate how many foreign markets are already closed to you as a manufacturer of such products as refrigerators, radios or automobiles."

It is one thing to engage in a mutually cooperative effort to unfreeze trade the world over. It is entirely another, and ridiculous to boot, to continue opening the markets of this country to others if they contravene the spirit and objective of the negotiations by continuing to devise restraints on trade. Common sense calls for the State Department to be tough on this point. After what has been done under reciprocal trade agreements of the past fifteen years, the U. S. is already one of the lowest-tariff nations in the world.



WHICH EQUIPMENT WOULD YOU SELECT for driving rock headings—a tractor-mounted continuous loader or a track-mounted shovel loader?—a rubber-tired shuttle car or a conventional mine car? The answer lies in this article.

Cycle Planning for Rock Headings

E&MJ's cover symbolizes the carefully planned five-cycle around-the-clock small-bore heading drive worked out in Examples A and B on pages 75 and 76. How to plan cycles for large and small headings, and how to select the proper equipment to do the prescribed work is explained by the author, who is a specialist on this subject.

RAY W. JENKINS[1]

TUNNEL DRIVING is like assembly-line production in an automobile plant. Each step in the operation including drilling, blasting, loading, hauling, and setting up again must be timed just right to produce a smooth operation. And, as in industrial production, the equipment selected must do exactly the required amount of work set forth in the planned cycle. This means that to plan a good tunnel job, you have to: 1. Determine how much work is to be done and how fast, and 2. Know what kind of equipment will do the job best. The following article shows how to approach this problem.

To simplify the discussion, this article discusses only rock headings driven with percussion drills, and where ground will stand long enough without support to permit completion of loading and timbering. Tunnels are classified according to size and length as shown in Table I, page 74.

These are the basic factors controlling the planning of tunnel driving and selection of equipment:

1. Time available, or rate of advance to be maintained.
2. The practical unit of advance, or depth of round. This depends on the drillability and blastability of the rock.
3. The size, number and proximity of headings in the project.
4. Labor and supervision available for the heading to be driven.

Time available is usually based on a contract, or, in the case of mines, the necessity for performing a certain program of development or access. Advances up to 50 ft. per 24 hr. have been made in small and medium headings, and 30 ft. per day in large headings. These high-speed advances were possible because of a well-balanced selection of equipment, competent workmen, and good supervision.

Slower advances than these may not necessarily be due to inefficient operation. Faulty selection of equipment, or failure to get fullest use out of that available may be a major cause.

When determining the rate of advance, the following statements, should be weighed carefully:

1. Rate of advance depends more on the degree and effectiveness of mechanization than on size of the heading, length of tunnel, or hardness of the rock.
2. Cost per unit of excavation depends more on the effective use of equipment and manpower than on the rate of advance and size of heading.
3. The number and size of equipment units should be selected to fulfill the time cycle with each unit operating at its most practical rate.

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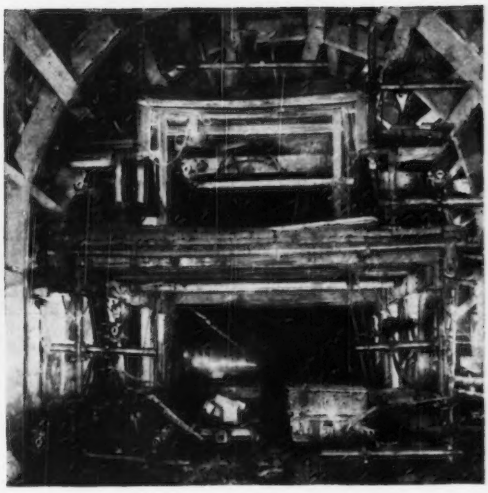


WHICH WOULD YOU SELECT—long-feed or short-feed drills?—bar-mounted or jib-mounted machines?—gantry-type, track type, or rubber-tired jumbo? Here again, the merits of these units are weighed by the author.

Means More Footage per Day

4. Manpower is most effective when a minimum number of trained workers have their work scheduled to prevent delay and interference. Apprentice training is a must.

5. Multiple headings are desirable when their close proximity permits use of specialized equipment and crews.

Other factors affecting rate of advance are existing transportation, power, compressed air, ventilation, and waste-rock disposal facilities.

Ventilation limitations can often be alleviated by using an exhaust system discharging into a foul-air circuit. Smoke clearance time and interference with other workings will determine whether faces can be blasted when ready or on a shift cycle.

Unit of Advance

After rate of advance has been selected, you must next determine the optimum depth of round. This is primarily a matter of developing the best cut for ground conditions, the amount of burden which can be placed on the squaring holes, the best size of hole, and the quantity of explosive to be used. Determination of the depth of round automatically fixes the number of rounds per shift to fulfill the objectives of the rate of advance. The following ideas will be helpful in deciding on round details:

Pull the deepest round possible. This procedure reduces percentage of time lost in setting up and tearing down, and in smoke delay—factors which are almost constant regardless of depth of round. Efficient crews are now pulling from 9 to 16 ft. round contrasted with 5 to 10 ft. a few years ago. Improved arrangement of cut holes and improved explosives and delays make this development possible.

Drill holes of economic size. The recent trend has been toward smaller diameter holes to take advantage of increased drilling speeds, smaller drills, and better concentration of explosives. Tungsten carbide bits and improved steel bits have made it possible to drill parallel-walled holes resulting in improved fragmentation of rock.

Select the proper drill size and feed length. The unit selected should give the lowest over-all drilling cost considering labor, bit and steel costs, and compressed air costs. The recent trend has been toward 1⅝-in. holes drilled by 3 or 3½-in. machines on 48-in. feeds or longer. The number of drills to be used will be determined from the number of holes in the round, the total footage to be drilled, and time allotted to drilling in the mining cycle.

Analyze drilling speed realistically. Drilling speeds mean very little unless the ratio of actual drilling time to over-all drilling time is considered. Table II shows the ratio of actual drilling time for various drill mountings. Percentages are based on actual field observations. Note that higher efficiences are obtained in units which have longer feeds, thereby cutting down the number of steel changes. Efficiency is also increased by cutting down time lost in spotting holes with such mechanical aids as the hydro jib. These types also permit better positioning of holes thereby eliminating overbreak, and allow more room for lifter machines.

A jumbo layout can be determined after these factors have been decided upon: number of drills; size and shape of headings; number of holes and their positions; depth of holes; drilling speed; over-all efficiency of feed length and mounting; and time allotted for drilling the cycle. See Example A which tells how to lay out a jumbo

Table I—Classification of Tunnels

Size	Height	Width
Large	19 to 23 ft.	16 ft. and wider
Medium	10 to 19 ft.	12 ft. to 16 ft.
Small	Up to 10 ft.	Up to 12 ft.
	Length	
Short		Up to 750 ft.
Intermediate		750 to 5,000 ft.
Long		Over 5,000 ft.

Tunnel sizes and lengths mentioned in this article conform to the above specifications.

Table II—Efficiency of Various Drill Mountings

Efficiency is rated in percent actual drilling time of overall drilling time.

Feed Length	Column and Arm Type	Boom Type[1]	Hydro Jib Type[2]
36 in.	30%	40%	50%
48 in.	40%	50%	60%
96 in.	....[3]	60%	75%

[1]Drill mounting which provides mechanical assistance for moving drills vertically.

[2]Mechanical assistance for positioning drills vertically and freedom of movement horizontally.

[3]Not practical to mount 96-in. feed on column and arms.

Table III—Transportation Equipment for Tunnel Work

General Classification: Continuous—Belt Haulage

Intermittent—Trackless: Truck, shuttle car, slusher

Track: Locomotive and cars

Applications to various sizes and lengths of tunnels

Length	Large	Medium	Small
Short (0-750 ft.)	Belt Shuttle car Truck Slusher	Belt Shuttle car Slusher Truck	Belt Slusher Track
Intermediate (750-5,000 ft.)	Belt Shuttle car Truck[1]	Track	Track
Long (More than 5,000 ft.)	Track	Track	Track

[1]Where adjacent headings permit breakthroughs and good ventilation.

Note: Belts are frequently used when the access heading is being driven for a belt entry.

Table IV—Classification of Loading Equipment

Type	Traction	Power	Capacity	Clean-up	Height Clearance Needed	Car Length
Continuous						
Medium	Crawler	Electric	100 c.f.m.	———	10 ft.	15 ft.
Small	Crawler	Electric	60 c.f.m.	———	9 ft.	15 ft.
Small	Rubber tired	Electric		———		15 ft.
Intermittent Trackless						
Power Shovel	Crawler	Electric	135 c.f.m.	———	17 ft.	———
Power Shovel	Crawler	Diesel	135 c.f.m.	———	17 ft.	———
Overshot Shovel	Crawler	Diesel	60 c.f.m.	———	15 ft.	10 ft.
Slusher	Fixed	Electric	———	———	To Fit	———
		Air	———	———	To Fit	———
		Diesel	———	———	To Fit	———
Slusher	Slide Mobile	Electric	———	———	To Fit	———
		Air	———	———	To Fit	———
		Diesel	———	———	To Fit	———
Slusher	Slide Track	Electric	———	———	To Fit	———
		Air	———	———	To Fit	———
		Diesel	———	———	To Fit	———
Shovel—Belt (Large)	Track	Electric	70 c.f.m.	18 ft. max.	110 in. min.	15 ft.
		Air	70 c.f.m.	18 ft. max.	110 in. min.	15 ft.
Shovel—Belt (Small)	Track	Electric	60 c.f.m.	15 ft. max.	94 in. min.	15 ft.
		Air	60 c.f.m.	15 ft. max.	94 in. min.	15 ft.
Shovel Loader (Large)	Track	Electric	50 c.f.m.	10 ft. max.	88 in. min.	9 ft.
		Air	50 c.f.m.	10 ft. max.	88 in. min.	9 ft.
Shovel Loader (Small)	Track	Electric	35 c.f.m.	8 ft. max.	73 in. min.	6 ft.
		Air	35 c.f.m.	8 ft. max.	73 in. min.	6 ft.

for a small bore hard-rock tunnel scheduled for 50 to 60-ft. advance per day.

After drilling details have been worked out, the next problem is to select transportation equipment to fit the planned tunnel cycle. Table III classifies haulage equipment and lists applications.

Belt haulage has been generally limited to handling of large tonnages because of high installation costs and lack of flexibility. Generally speaking, it has been used only in large-bore, short-length tunnels or in long headings driven for permanent belt installations. One of the big disadvantages encountered with belt haulage is in extending the belt to the face after blasting. During the blast it must be kept back from 75 to 200 ft. to protect it from fly rock. The belt must also be loaded while it is being moved to the face as the loader picks up scattered fly rock and the toe of the muck pile. One answer to this problem has been the use of a "baby" belt suspended on a monorail over the main belt. This is practical, however, only to distances of 75 ft. because of excess weight of longer units.

A shuttle car operating between the loader and the belt station is also effective. Thus the belt can be advanced in longer sections, and the efficiency of the shuttle car is much higher than mine car efficiency with conventional car-changing practices.

The use of belts requires trackless equipment for drilling and loading. Such equipment is now available. For instance, a rubber-tired, self-propelled unit now carries one or more drill jibs. Tramming power for this unit comes from two reversible air motors, each of which propels the wheels on one side of the machine. Steering is accomplished in a manner similar to that used with caterpillar treads.

Diesel equipment, shuttle cars, trucks, and earth movers are coming into rather wide use in short-length, large-bore tunnels. Here again economy of trackless equipment is recognized. Trucks and earth movers are used primarily with power shovels while the newly developed diesel shuttle car generally operates with continuous loaders. Power shovels, however, may be used with the shuttle car. One advantage of this type of haulage over track systems comes in disposing of waste rock. Frequently broken rock from large bores must

Example A—Layout of a Jumbo

Size of Heading—10-ft. horseshoe
Advance per cycle—10 ft.
Allotted drilling time—70 to 80 min.

ROUND DETAILS—see drawing
- Depth of holes
  - Slab holes—11 ft.
  - Burn holes—12 ft.
- Size of holes
  - Slab holes—1⅝ in.
  - Burn holes—3 in.
- Number of holes
  - Slab holes—43
  - Burn holes—2
- Total footage to drill
  - Slab holes—473 ft.
  - Burn holes—24 ft.
- Drill speed
  - Slab holes—24 in. per min.
  - Burn holes—12 in. per min.

EQUIPMENT:
- Drills—3½-in. drills mounted on 11 ft. feeds
- Mounting—Hydro jib type jumbo
- Efficiency—75% (See Table II)
- Total minutes of drilling at 75% efficiency
  - 473 at 1.5 f.p.m. = 316 min.
  - 24 at .75 f.p.m. = 32 min.

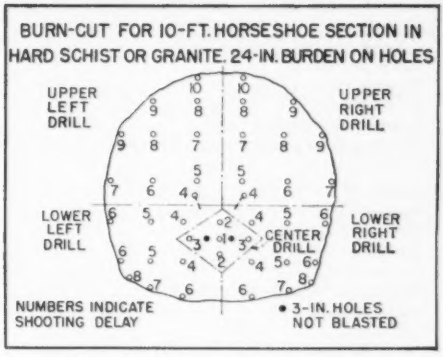
Total 348/70 = 5 drills

HOLE DISTRIBUTION

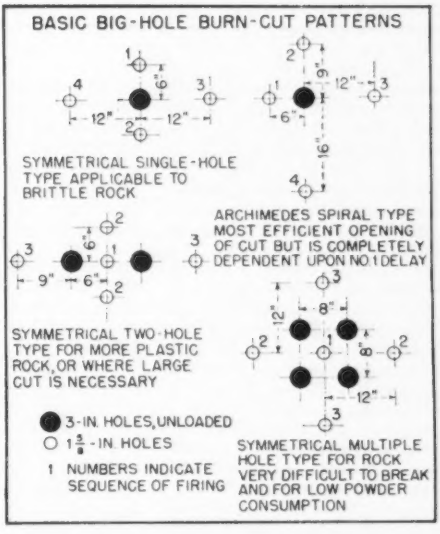
Drill	Number of Holes	Depth	Drill Speed	Minutes
Upper right	10	11 ft.	1.5 f.p.m.*	70.3
Upper left	10	11	1.5	70.3
Lower right	9	11	1.5	65
Lower left	9	11	1.5	65
Center	5	12	1.5	40
Center burn	2	12	0.75**	30

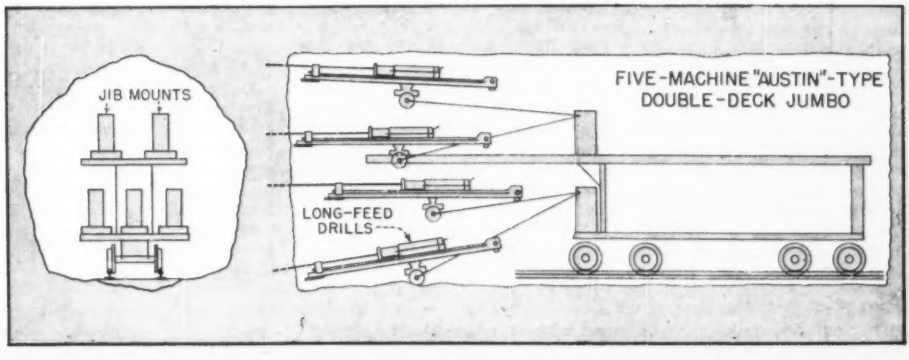
1. In planning the details note these points: 1. All machines should finish drilling at approximately the same time.
2. Where possible, lifter or lower machines should be favored since they usually work under the most difficult conditions.
3. For burn cuts, one machine should be used to drill the entire cut to insure parallel holes and to eliminate confusion.

*1⅝-in. holes.
**3-in. center burn.


BURN-CUT FOR 10-FT. HORSESHOE SECTION IN HARD SCHIST OR GRANITE. 24-IN. BURDEN ON HOLES
UPPER LEFT DRILL
UPPER RIGHT DRILL
LOWER LEFT DRILL
LOWER RIGHT DRILL
CENTER DRILL
NUMBERS INDICATE SHOOTING DELAY
• 3-IN. HOLES NOT BLASTED

DISTRIBUTION of holes for five machines.


BASIC BIG-HOLE BURN-CUT PATTERNS
SYMMETRICAL SINGLE-HOLE TYPE APPLICABLE TO BRITTLE ROCK
ARCHIMEDES SPIRAL TYPE MOST EFFICIENT OPENING OF CUT BUT IS COMPLETELY DEPENDENT UPON NO. 1 DELAY
SYMMETRICAL TWO-HOLE TYPE FOR MORE PLASTIC ROCK, OR WHERE LARGE CUT IS NECESSARY
3-IN. HOLES, UNLOADED
1⅝-IN. HOLES
1 NUMBERS INDICATE SEQUENCE OF FIRING
SYMMETRICAL MULTIPLE HOLE TYPE FOR ROCK VERY DIFFICULT TO BREAK AND FOR LOW POWDER CONSUMPTION



FIVE MACHINES required to drill out 45-hole horseshoe round are mounted on a double-deck jumbo as shown. Type of burn cut to be used varies with rock encountered. Four possible types of burn cuts are shown in the center box, above.

Example B—Cycle Calculations for Small-Bore Tunnel[1]

(For full-face tunnel; 10-ft. horsehoe cross-section; desired rate of advance, 50 ft. per 24 hr.)
Note: Several related items such as car and train change time have been grouped in cover design.

Advance per cycle (Depth of round)	10 ft.	TIME CYCLE BASED ON	
Cycles per day	5	Loading time	27 min.
Time per cycle	288 min.	Car change time	40 min.
Cross-section	100 sq. ft.	Train change time[2]	36 min.
Volume of solid rock per round	1000 cu. ft.	Pick up flyrock (estimated)	20 min.
Expansion to broken rock	1600 cu. ft.	Clean up face[2]	20 min.
		Move loader in and out	10 min.
HAULAGE		Total time, Loading Cycle	153 min.
Car size	60 cu. ft.	DRILLING	
Cars per train	10	Set up jumbo	10 min.
Car change system	Cherry Picker	Drill[1]	70 min.
Car change time	1 to 1.5 min.	Tear down jumbo	10 min.
Train change time	18 min.	Prepare to blast	30 min.
Loader capacity	60 c.f.m.	Smoke delay	15 min.
Cars per round	27	Total (Drill, Blast, and Smoke)	135 min.
Trains per round	3	Add Loading Cycle Time	153 min.
Trains to change per round	2	Total Cycle Time	288 min.

[1]Incorporates drilling cycle in Example A. [2]This time used at face to advance slide rails or portable track.

be spread over extensive areas. With track systems this requires expensive track shifting. The shuttle car, however, distributes the fill evenly over the edge of a bank without losing time for turning around. This feature of being able to load and discharge without turning around and the smaller clearance of shuttle cars often makes it possible to use them economically with power shovels in narrow widths.

Truck or earth mover haulage have been used most effectively where waste rock had to be hauled a long distance. Here the higher speed of trucks may be used to better advantage. Diesel haulage, however, can be applied only where ventilation is adequate, as in large bore headings of short length, twin large bores with breakthroughs, or in enlarging a completed pilot heading.

Slusher transportation combines loading and haulage in one operation with moderate flexibility. Examples of this flexibility include the use of slushers with scraper slides for loading trucks; slushers installed to spoil waste rock outside the portal; combinations of slushers and track systems with discharge into chutes or into cars.

Selection of slushing equipment depends on the volume of material to be handled per unit of time. Scraper capacity and rope speed determine the rate of haulage and dictate the size of the hoist required. Scraping distance controls the drum capacity. In some cases, distances up to 700 ft. have been practical for scraping. The choice between two and three-drum slushers is determined by the width of the room. One main limitation is that slusher haulage requires straight-line drifts.

Track transportation is almost mandatory for intermediate and long tunnels and rock headings. Trolley, diesel, and battery locomotives are regularly used and the trend has been toward use of the largest units permitted by clearance. Cars selected for recent jobs have been the largest possible with five-yard cars being used generally in the tunnels. Large cars are being used in smaller headings, and it is not uncommon to see 50-cu.ft. cars of Granby design in headings 8 ft. high by 6 ft. wide.

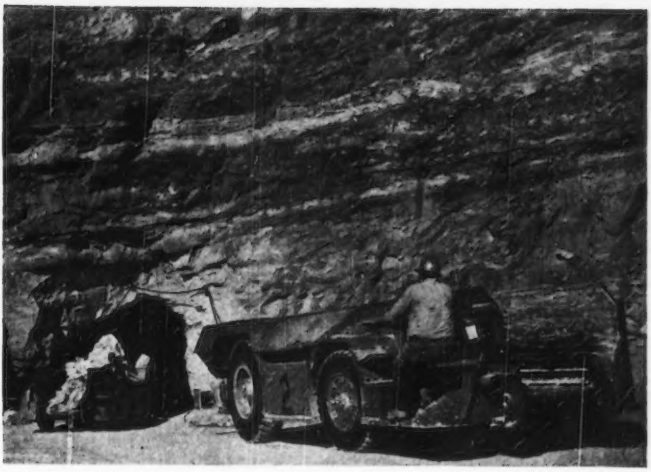
Car Change, a Big Factor

The main problem with track haulage is changing cars behind the loader. Time studies indicate that, under average conditions, a loader seldom operates more than 30% of the time it is at the face. Seventy percent of the time is spent waiting for cars or other services. Large bore headings permit the passing of shuttle cars and trucks with a minimum of delay, and allow nearly continuous operation of power shovels and loaders. Loading is most efficient when one shuttle car is spotted while another is being loaded. In medium-width headings which permit double-track haulage this method of spotting cars is feasible. Storage of loaded and unloaded cars is easier with a double-track arrangement. This system also eliminates the need for advancing permanent track while loading. Portable track may be used during loading and permanent track laid during drilling. Efficient operation of the double-track system demands convenient movable crossover points near the face.

Single-track headings make it difficult to change cars. Single car passing points, such as side transfers and cherry pickers, are generally used. These require extra excavations and must be near the face or car-change time becomes excessive. Two hundred feet is usually the maximum distance between passing points and the face. Unless the jumbo is moved to the surface during loading, two passing points must be maintained to provide storage space while loading. Another serious limitation to the system is the need for train changing facilities or a means for fast unloading since one round usually requires two or more trains of cars.

One solution to eliminate the problem of car changing is the over-the-top conveyor which will load several cars at one pass. This system will often load cars for a complete round. This system requires careful planning because the conveyor must follow the loader from its position during blasting to the face.

Careful selection of loading equipment is the key to high efficiency. One important factor in loader selection, aside from physical size limitations, is the clean-up range and the ability to properly load the haulage equipment chosen.



VERSATILITY OF SHUTTLE CARS for tunnel waste disposal is important.

(See Table IV.) The problem in large bores is comparatively simple. Here trackless equipment allows the entire floor to be covered by the loader and the haulage units to be loaded to the proper capacity. Crawler type loaders also have the advantage of wide clean-up range, but they are definitely limited in the size haulage unit they can fill properly. Also they are generally diesel powered and so must be used in short-length, large and medium bores.

Select Loader With Care

The loading unit should keep the transportation and car changing system operating at top capacity. Except for power shovels, loader capacity usually depends on the size of the loader, and if the proper size loader is chosen for the haulage units, capacity will generally be adequate.

In medium and small bores, selection of the loader to match clean-up range and car size requires more care. Slushers mounted on scraper slides have been successful, but, in general, they can perform a satisfactory job only if they are moved close to the blasted rock. In addition, the floor is often off-grade. This makes it difficult to move a drill jumbo into the face. Most of these problems may be solved by mounting the slusher so that it can follow the face closely. One answer to this is a recently contemplated installation with the drills mounted on the slusher slide which serves as a jumbo and a loader. Scraper slides are also useful in loading large or extra long cars which cannot be loaded properly by available loaders in small and medium bores.

In general, scraper slides are not flexible enough for a high rate of advance. They are not applicable to multiple heading arrangements. Their best application is in faces where wide cleanup width is desired or in special instances where rock must be moved back from the face without waiting for transportation. However, the scraper slide has the lowest capital cost in comparison with loading capacity.

Trackless and track-mounted loaders are almost universally used for medium and short bores of long and intermediate lengths. These loaders are used with track haulage and the car changing systems described previously. Track mounted loading equipment for medium bores has been standard for many years. However, introduction of continuous loaders combines the high flexibility and capacity of this type of equipment with track haulage, to speed up the loading cycle and, thus, decrease costs. Most of the improvement arises from: (1) improved cleanup of the face for drilling; (2) elimination of heavy track to the face; (3) elimination of heavy slide rails; and (4) higher loading capacity. With trackless loaders, sections of light, portable track are used behind the loader, permitting the laying of heavy permanent track behind the flyrock area on a clean floor.

Shovel loaders are used primarily in small bores or in double-track headings where transportation capacity will not warrant the high capacity of larger loaders. Capacity and cleanup width depend on the car size while the rate at which they can load out a round will depend largely on the car service.

Methods of Cycling

As an example of cycling, let us consider a full-face small bore tunnel of 10-ft. horseshoe cross-section in which it is desirable to maintain a rate of advance of 50 ft. per 24 hours. Calculations are given in Example B.

In Example B haulage equipment is adequate for rate of advance required. Larger cars, longer trains, and a larger loader would be required for faster advance. This example also illustrates the necessity for closely coordinating drilling equipment to drill the round during the time remaining after loading.

Wherever possible two or more operations should be performed simultaneously. Thus during loading, the walls and back could be scaled. Portable track could be laid while trains are changed. Permanent track could be laid while rounds are drilled. If timbering is required, caps could be boomed and the back lagged during loading operations. All possible operations should be performed away from the face to allow greatest freedom in loading, drilling and blasting.

Arrangement of equipment in headings must be carefully planned. In single-track headings, the jumbo and loader must pass each other unless removed to the surface. Provision for passing must be made by installing two passing switches or cherry pickers. In larger headings a gantry type jumbo is preferred and usually provides an arrangement for passing. In some instances, gantry type jumbos have been used with cherry pickers installed on them. Deck spacing on most gantry type jumbos are 6½ to 7 ft.

In summary, here are the steps in planning a tunnel drive:

1. Determine the depth of round and rate of advance.
2. Then determine the time available per cycle.
3. Choose the proper equipment to do the job required in the allotted time.
4. Select ventilation and auxiliary equipment to fit in with the mining cycle.
5. Don't overlook the fact that properly trained personnel and alert supervision are equally vital.

INSIDE YUGOSLAVIA—
What I Saw at the Bor Copper Mine

JOHN J. CHRISTIE
McGraw-Hill World News
Frankfurt
Germany

YUGOSLAVIA'S FAMOUS BOR copper mine, developed originally by French capital, is in for considerable overhauling when the Tito regime receives the new mining equipment now on order in the United States. Out of the $20,000,000 loan Marshall Tito got from the Export-Import Bank, $3,200,000 is earmarked for mining equipment for the Bor mine.

When it is all in and working, the present Bor management will far exceed the French group's yearly output of around 750,000 tons of copper ore averaging about 5% copper. This production would rank the Bor mine on about the level of the Miami Copper Co. in the United States, in tonnage at least.

Tito's men will take particular delight in modernizing the Bor mine. As good socialists, they like to cite it as an example of prewar wasteful capitalist exploitation of a Yugoslav resource. They point to 40% of the ore on some levels left in pillars, and to the practice of using horses for underground haulage.

What Bor's Like?

One of the questions uppermost in my mind when I went to Yugoslavia was, "What is it like to work under a Communist regime?" I find that one can't give a flat answer. Superficially, everyone seems busy and reasonably happy. Certainly there's no lack of enthusiasm, because the Yugoslavs are intensely proud of their accomplishments and aware of their opportunities.

But I sensed, without exception, in everyone I talked to, and I must have talked to hundreds of persons in the mines and in the Government, the ever-present frustration and fear that the police state inevitably generates. No one in Yugoslavia is ever entirely free of its shadow.

When I visited Bor, I saw much building activity. New houses were going up around the pits and the mine shaft. The administration buildings are being enlarged. A few miles away, a complete new miners' community was being built.

There are about a dozen restaurants for miners around Bor. A meal ticket good for three meals a day for a month costs 1,000 dinars ($20 at the official rate of 50 dinars to the dollar). These places serve meals that are above the average I found elsewhere in Yugoslavia. Also an underground miner gets a fourth daily meal free.

Incentives Used

An elaborate scoreboard is set up in the center of town near the railroad station, posting outstanding individual and group production records. During my visit a group of eight men had just been given a 24,000-dinar prize to share. Sometimes, radios and clothing are given as prizes. And a radio in Bor is a prize not to be sniffed at. According to one resident, some 250 Holland-made Phillips radio sets were sold in Bor last November. Their cost, according to him, was 32,600 dinars.

Bor has an extensive education program. A group of young miners between the ages of 14 and 17 has embarked on a three-year course, requiring four hours per day in the pit and four in the classroom. There is also an advanced course for older miners training for supervisory duties.

Among the workers at Bor are a few Yugoslav emigrants back from Canada. Those who were resettled in Bor are ones who had experience in Canadian mines. Many of them were made supervisors simply because of their foreign experience. The ones with responsible jobs are particularly caustic in commenting on the primitive equipment and the wasteful mining methods of the French.

As elsewhere, there is a shortage of experienced technical and managerial personnel. The Tito regime's feverish efforts to generate native know-how is reflected by the size of the Belgrade institute's student body. Once accommodating 2,000 students in all branches of engineering, it now has 7,000.

The Bor Mine

The mine lies in the center of the Timok Massif, a noted andesite intrusion 80 km. long and 12 to 15 km. in width. Past geological surveys of the Timok Massif have indicated tremendous reserves of ore.

The Yugoslavs, although unable to make conclusive findings until they get diamond drilling equipment, have begun an extensive exploration program with the primitive equipment at hand. There are now ten drill sites on a line running northwest of Bor, and another series is scheduled on a line extending southeast.

Mining at Bor has been carried on in two separate orebodies, both of which are being worked simultaneously as open-cast and underground operations. These orebodies, the Tilva Mika (TM) and Culka Dulkan (CD), are about 200 meters apart.

A common shaft, the Wajfart, going to a depth of 100 meters, located outside the orebodies, serves both underground workings. Main haulage tunnels run from the Wajfart shaft to the 5th or main levels of TM and CD, a distance of 400 meters to the former and 200 to the latter.

Wajfart shaft is the outlet for most ore mined by open pit as well as underground. All ore from the CD open pit is passed through chutes to the 5th level CD for underground haulage to the shaft. All but a small percentage of ore from TM open pit is handled the same way. The rest can be loaded directly on narrow gage rail cars at one end of the pit.

French development of Bor began in 1903 with the sinking of a shaft into the CD orebody. Known as the old Sistek shaft, it was closed down several years later when the Wajfart shaft was built for expanded operations. It now serves as outlet for the dewatering system of both underground workings.

Underground operations by the French in CD consisted of developing three levels, i.e., the 5th or main

Why Yugoslavia's Mines Are Important to You . . .

A FEW MONTHS AGO, U. S. metal miners were startled to learn that Yugoslavia's strong man, Marshall Tito, having broken with his former master, Stalin, had turned to the West for help. Specifically, Tito wanted U. S. dollars to buy mining machinery and other items, the loans to be repaid in part by shipments to the U. S. of metals from the Bor copper mine and the Trepca lead-zinc mine.

Tito got $20,000,000 from the Export-Import Bank, and may get more from other sources. This means increased mine output, and more metal available for export to the United States. In past months such metal has been in firm hands and has not been a major market influence. But until old-time trade channels are restored, Yugoslav metal will increasingly seek outlet in the USA.

How big a factor in world metal markets are Yugoslavian mines likely to be? This first-hand account of Tito's plans for the Bor copper mine gives part of the answer. Next month, we will present Jack Christie's account of his visit to Trepca.

. . . And What You Can Expect From Them

THE YUGOSLAVS suffer under the typical totalitarian government's dislike for outside inspection of their activities. Yet, as this article shows, they have nothing to be ashamed of. Here is the essence of what Jack Christie found:

1. The Bor mine, mill, and smelter badly need almost everything in the way of equipment that one can name. The Yugoslavs want to buy American equipment.

2. Despite their handicap, the Yugoslavs have probably pushed Bor's output at least up to the French company's prewar rate of about 40,000 tons of blister copper annually. The Yugoslavs want to sell this copper in the United States.

3. Tito is determined to do everything possible to build up his country's mines as a basis for trade with the West.

4. The frustration and fear generated by living in a police state haunted every one of the hundred or more persons consulted for this article, right from the humblest Bor miner to the highest officials in Belgrade.

level and two above, the 4th and 3rd. The Yugoslavs are now working the 6th level, which they opened in 1948. Ore is hoisted from the 6th to the 5th by winch.

Open pit development was started by the French in 1910. This progressed down to complete removal of the pillars left in the 3rd horizon under their direction. Since then open pit mining has gone into the 4th level. The Yugoslavs plan to go through the 5th.

Underground development in TM went to the opening of the 9th level prewar. Ore is now being extracted from the 7th and 9th, stoping having been skipped for the 8th. Ore is hoisted from each of these lower levels to the 5th by separate hoists. Meantime, the Yugoslavs have begun drifting and cross-cutting in the 10th and 11th horizons.

The Germans started the TM open pit operations during the war, as a quicker and easier means of boosting production. They also brought in some power shovels. The TM open pit is down to the 3rd level, and it is also planned to go through the 5th level here.

Gold Ore as Fill

Several tiers of valuable gold bearing quartz and silica tower above the TM open pit. This formation, known as "the silica mountain," is also the mine's source of fill. Power shovels are now working on two or three of the higher benches, which also have rail lines. However, there are not enough power shovels and scrapers for this combination open pit mining and quarrying operation.

Another promising but undeveloped orebody is the Tilva Ronton. It can be reached by a tunnel from the 3rd level of TM. The Yugoslavs have begun drifting and crosscutting in the TR 3rd level. They also plan to work this orebody by open pit and have cleared the ground in preparation. No important progress can be made on Tilva Ronton, however, until new equipment is available.

The other known orebody in the immediate vicinity of present operations is the Tilva Ros, which has not been well investigated as yet. Preliminary surveys indicate that it's a low grade orebody suited to open pit development.

More Mechanization

Preparations are being made for greater mechanization of underground mining. According to Bor's chief engineer, square set and top slicing methods will be employed in future. And, to provide for use of scrapers, the chute pattern will be changed. The Yugoslavs also prefer to use skips in any new underground developments.

Bor's underground workings are exceptionally well ventilated and its tramways and working places are well-kept. This makes its antiquated equipment all the more incongruous.

Sixty horses are kept underground for haulage requirements. Virtually all loading in the stopes is by hand shovel, as there are no more than four scrapers available underground at any given time. Handling of fill likewise is manual.

Underground loading and haulage methods, of course, were in keeping with drilling methods. Under the French, old hand-cranked drills were used, but the Germans brought in a few modern machines during the war. Just after the war, the Yugoslavs got a few Ingersoll-Rands through UNRRA. Lack of spare parts for these drills has by now reached a disheartening stage.

Equipment Needed

Bor is getting $3,200,000 out of the Export-Import Bank loan. Orders now being placed in the U. S. include: 393 drills with spare parts; 19 electric locomotives; 7 bulldozers for open pit mining; 6 hoists of one and two drums; 12 scrapers for underground; 8 loading shovels for open pit; 130 tons of piping; 120 tons of steel cable plus large quantities of rubber and telephone cable; and wheel and axle sets with Timken bearings for 700 mine cars.

The Yugoslavs boast they're producing more ore at Bor than the French, but, of course, they won't provide figures to support this claim. They say, too, that they have to put more ore through flotation

because they don't neglect low grade ore as was the French policy. Whether this is true or not, they have expanded flotation capacity.

It seems reasonable to assume that the Yugoslavs are producing as much as the French, which would mean around 750,000 tons of ore per year. (According to UN statistics, Yugoslav copper ore production for the years 1936-39 averaged 751,500 metric tons.) There are two reasons for this assumption:

1. French methods were primitive anyway. Failure thus far to get mechanized equipment shouldn't have the same ill effects on output as would be the case at mines formerly more modern. 2. The Yugoslavs admit having a larger working force than prewar. They may not be using more workers for the same mining operation, but they have two open pit workings, whereas the French had one.

A Five-Year Plan

But, even if Bor is producing ore at the prewar rate, its output must be far below the goal set in the Five Year Plan because the Tito government has blasted Bor publicly on at least two occasions.

Minister of Mines Svetozar Vukmanovic, in his 1949 year-end report, declared that the over-all mining plan had been fulfilled by 98% and the non-ferrous metal production target by 101%, but that "in copper production, on the other hand, there has been hardly any progress." He went into no details.

The official government newspaper, Borba, carried a sharp but generally worded criticism of Bor shortly before I visited the mine.

Only explanation seems to be that the government has set a goal for Bor that it cannot meet without new equipment.

Equipment in the mill, flotation plant and smelter is in run-down condition. Out of its share of the Export-Import Bank loan, Bor is to get spare parts for the mill's crushers; pumps, piping and other spare parts for flotation machinery; and conveyors for handling blister and electrolytic copper.

However, before long the Yugoslavs will have to get replacement units such as smelting furnaces, converters, etc. Engineers also expressed the hope that they could get new crushers for the mill eventually. Some new installations may be possible out of proposed World Bank loans and through trade agreements with Germany and Britain.

The flotation plant established by the French in 1933 had capacity for treating only 300 tons of ore per day. This capacity was increased to 2,000 tons per day in 1938, when the French also built an electrolytic copper refinery with an annual capacity of 12,000 tons.

Only the flotation plant has expanded since the war. A 30% increase in capacity has been gained by installation of Krupp equipment from German reparations, and Denver flotation machines provided through UNRRA. Due to lack of parts, however, the total capacity is not fully effective.

Smelter Outworn

Average copper content of ore going to flotation is said to be 2 to 3%. Bor copper concentrate contains about 25% copper. About 20% of the ore, which has a 6 to 8% copper content on the average, goes direct to the smelter. Ore has to contain at least 5% copper to be used with the charge going into the blast furnaces.

There is a battery of 33 roasters, all of which are the originals installed by the French. Most of the sinter from the roasters has to be hand-shoveled into monorail cars for transport to the blast furnaces.

The five blast furnaces also are the originals. Limestone for the charge is transported by cableway from a quarry about 7 km. away. The Yugoslavs include slag from the converters in their furnace charge. They also intend eventually to process tremendous concentrations of discarded slag left by their predecessors. Coke from Holland was being used for the furnaces at the time of my visit.

There are six Peirce-Smith converters, all of which were installed before the war. A high grade gold-bearing silica, quarried from the formation above the TM open pit, is used as flux in the converters.

Bor's blister copper is said to have 88 to 90% copper, about 100 grams of gold, and double this amount of silver per ton. Average output in the years 1936-39 was 40,600 metric tons of blister copper.

Only about 30% of the blister copper can be handled by the electrolytic refinery's present capacity. The plant is reported to have been erected at the insistence of the prewar government as a means of securing some of the gold return. Previously all blister copper was shipped to foreign refiners, principally Belgian, American or German. The Yugoslavs began enlarging the building housing the electrolytic plant in preparation for expanded operations. It is not known when equipment will be available for increasing capacity.

Bor's electrolytic copper is of noted quality. Arsenic, bismuth and other impurities are reported to amount to only one-tenth of one percent.

The Yugoslavs have listed among their many project proposals for World Bank funds the building of a plant for cyaniding gold-bearing quartz. There are enormous reserves in the formation from which silica and fill are now being quarried. However, there are so many priority projects that it is unlikely that the half-million dollars required for this purpose will be among them.

Another project, also more in the realm of long-range planning, is the establishment of facilities for capturing the tremendous amount of sulphur dioxide that goes into the atmosphere with great damage to agricultural land in the Bor area. It is reported that the prewar government was compelled to pay considerable amounts in damages as a result of this menace.

Sulphur content of the ore runs about 30%. Sulphur dioxide represents 2% of the gas from the chimneys of the blast furnaces and about 8% from the converters.

Manufacture of sulphuric acid at Bor is held to be an impractical proposition for two reasons: (1) Shortage of water in this area, and (2) difficulty of transporting sulphuric acid in the country. The rail transport system is incredibly primitive and dilapidated. It would be some time before equipment for transporting acids in bulk quantities could be afforded.

An installation for transforming sulphur dioxide into solid sulphur is considered a sounder proposition. It would be easier to transport solid sulphur to a more strategically located sulphuric acid plant in the country, or simply to export it. However, the whole idea is a long way from serious consideration, let alone implementation.

Tito's Future

Does Tito's break with the Kremlin portend a more favorable climate for the development and growth of industry than the Soviet version of the Communist state?

At this early stage in the unfolding of Titoism, this question can be answered only in an oblique manner.

The Yugoslavs, due to the nature

"An Egg for Breakfast in Yugoslavia," or "How Foreign Correspondents Get By."

TO: Russell Anderson, McGraw-Hill World News, New York
FROM: Jack Christie, Frankfurt, Germany

Dear Russ:

Enclosed is my expense account covering the trip to Yugoslavia for Engineering and Mining Journal.

I had no idea that Yugoslavia was going to be so expensive. The official exchange rate of 50 dinars to the dollar is unrealistic in the extreme. You can get 300 if you know where to look.

I found almost at once that my having three square meals a day would be out of the question. For me to insist upon eating what I wanted could only have resulted in Mr. McGraw's mortgaging the building on 42nd Street to get me out from behind the "Iron Curtain." And, anyway, I must admit that my stomach wasn't strong enough to eat three full-sized meals.

I wish to apologize to the Accounting Department for having had an egg for breakfast on two or three occasions. However, I did this purely for prestige purposes. There were occasions when there was someone at the table I wanted to impress. I did try to make up for extravagances of this sort by skimping on succeeding meals until I felt I'd evened the score.

I was prepared to complain about the closet-like room they handed me when I got to the hotel in Belgrade. But, when I found out what it was costing per night, without extras, I told the management I was highly pleased with it. I was afraid they'd suggest a more expensive room.

But, my luck in this respect didn't hold. The lights went out in my room on the third day and nobody seemed to know how to fix the fuses or switch or whatever had gone wrong. And, there were no candles to be had. So I have to move anyway.

The move to another room was heartbreaking for two reasons: (1), it meant 60 c. more per night and by the third day I knew that every 60 c. was going to count, (2), it meant moving from the second to the third floor and that wasn't good because sometimes the water pressure is out of kilter and the water doesn't get up to the third.

Still I had nothing really serious to complain about, and went happily along until, by virtue of having to stay longer than I anticipated, I realized that my financial position was becoming desperate.

In fact, during the last few days I was sort of panicky as to how I'd make ends meet. Then, one gloomy March day, as I sat in my room watching an interesting specimen of bug traversing the floor, I recalled another gloomy March day back in 1932 when FDR declared: "We have nothing to fear but fear itself." That thought changed the entire course of my economic existence in Belgrade.

I had, in fact, been toying with the idea of resorting to the black market. But, in Yugoslavia it's risky business. They like to think that their society is free of such sordid influences. And, indeed, there's not nearly the blackmarketing in Yugoslavia that I've seen elsewhere.

Nevertheless, I determined to take the risk. I managed to make arrangements to meet an Italian in the men's room of another hotel and there passed him some dollars for dinars. He could change them for lira in Trieste.

Prior to doing this I had made a very careful appraisal of my wardrobe with the idea of hocking something at one of the city's bucket shops. But I could see my way clear to part only with a pair of trousers. These were the trousers I wore on my trip to the mines. I suspected them of being lousy anyway, even though I had sprayed them with DDT. I didn't want to put them back in my suitcase.

The trousers, however, I had tentatively committed and couldn't count on for current expenses. A fellow correspondent had been extremely helpful in loaning me some heavy clothing for my trip to the mines. This poor devil was as hard up as I. So, I decided to will him the trousers and he could hock them when they got back from the cleaners. We thought he ought to get at least a thousand dinars for them.

You will note that in Part V of the enclosed document I point out that I ceased detailed entries when I began digging into the black dinars. There was no point in keeping track on this down to the last dinar. It wouldn't mean anything anyway, because what exchange rate would I use? I'm sure that we've come out ahead on this deal, but next time I'll have to raise my sights on the estimated cost.

Anyhow, I was allowed to visit both mines unaccompanied. They let me make complete inspections at both properties. The only trouble I had was in trying to get economic information, because the Tito regime has a hard and fast rule against divulging such figures. My estimates in these articles are based on countless interviews. I got bits and pieces of information from everyone who might know anything at all about Bor and Trepca.

I've tried to make these articles objective, because the Yugoslavs can take criticism, if it's constructive. Certainly, whatever we think of Tito and his government, there's no doubt but that Yugoslavia could be a big factor in the mining business. The reserves are there, and Tito's determined to mine them.

How about another trip down there next year? I liked it.

Best regards,
Jack Christie

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of their present political predicament, will have Western technical assistance in their bid for industrialization that they would not otherwise. But it will be technical assistance in the strictest sense.

For, it is certain that the regime will see that this assistance is confined to the basic requirements of getting new equipment installed and personnel trained. In other words, the regime will be careful to see that Western financial assistance becomes no wedge for influencing policy.

More positive effects on industry will come from Tito's own efforts to distinguish his brand of socialism from that of the Kremlin. One step of particular significance to mining already has been taken in this direction. That is the recent measure providing for decentralization of authority over industry.

The decree calls for a divorcement of planning functions and operational control. The planners are to form the federal ministeries in Belgrade. Those charged with operational control are to be assigned to the governments of the republics and in some cases down to districts and municipalities.

Yugoslavia's economy is largely of a regional nature. This is particularly true of the extraction industries, where the decentralization is being initiated. Thus, there is now an opportunity both to shorten the chain of command and to create a more or less specialist type of control close to mining operations.

The move fits into the Tito concept that a nation should adapt socialism to the peculiar needs of its economy and not be forced to accept a rigid pattern laid down and controlled by Moscow.

The trouble is, of course, that Titoism may prove distinctive only in an ideological sense. It may continue as a veneer covering a police state no different than any other.

Anyone who has experienced this cramped feeling of a police state has reason to doubt that any one form can lead to a more productive economy than another. Time will tell whether or not Tito can prove otherwise.

TUNGSTEN CONCENTRATE leaves this dredge via conveyor belt on bow gantry (note discharge spigot) into trucks.

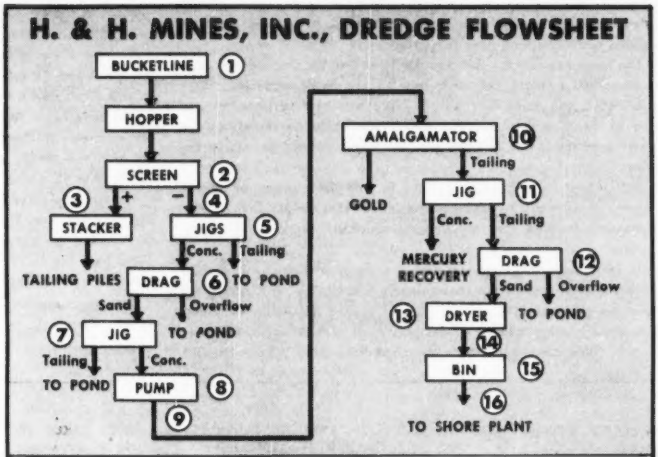
Unique Bucketline Dredge

Here is the only U. S. gold dredge that L-208 couldn't shut down. The WPB kept it going because of the tungsten concentrate the dredge produces. This placer ship-to-shore operation is as interesting as it is different.

W. A. NOON
Manager
H. & H. Mines, Inc.
Drummond, Mont.

THE GOLD-HUNTERS working along Henderson Creek in Montana back in the 1860's were baffled and annoyed by a heavy grey sand they ran into. It clogged their riffles and spoiled their tempers. Nobody knew, or cared, what it was.

This grey sand, which the old-timers dug out of their sluice boxes and tossed aside, is scheelite. It fluoresces beautifully under ultra-violet light. We are recovering it not only from these 1860 tailings, but from virgin placer ground as well. To do that, we have to combine dredging with milling, both aboard the dredge and on shore, in

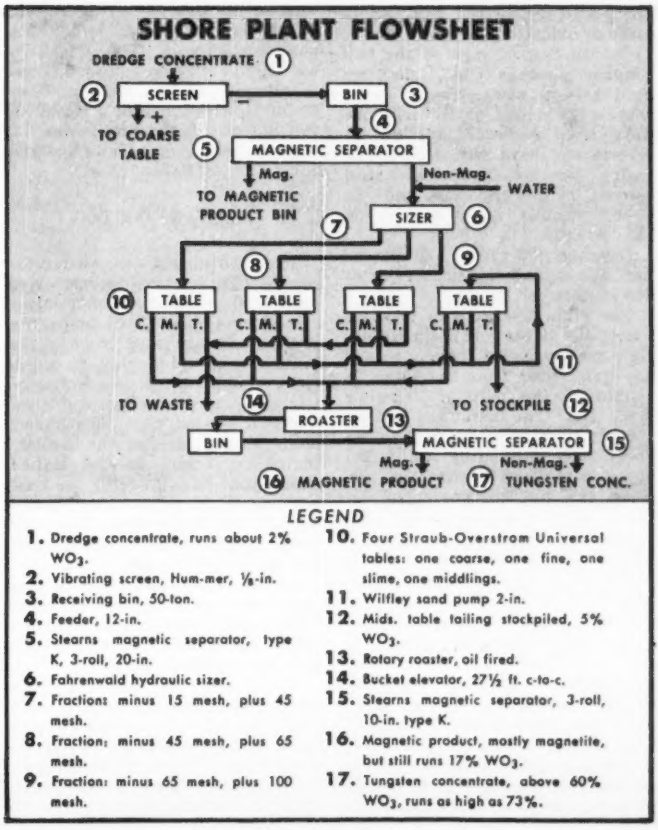


LEGEND

1. Line has 66 bolted-lip buckets, 3⅞ cu. ft. each; capacity, 2,800 cu. yd. per day.
2. Trommel screen, 4½x25 ft.; screening section 18 ft. long, ½-in. round holes.
3. Stacker, 26-in. belt.
4. Distributor for screen undersize, 1,400 cu. yd. daily.
5. Rougher jigs, 16 cells, 42x42-in. Pan American placer type, balanced. Arranged in 8 flow lines, 4 on each side of screen, 2 cells to each.
6. Dewatering Esperanza-type, drag, 14-in., 45 tons of concentrate daily.
7. Cleaner jig, 2 cells in series, 42x42-in. Pan American placer type.
8. Wilfley sand pump, 2-in., 9 tons daily.
9. Mercury feeder.
10. Titan amalgamator.
11. Scavenger jig, 2-cell, 18x18-in. Pan-American pulsator type.
12. Dewatering drag, 7-in.
13. Rotary dryer, 3x12-ft., oil fired.
14. Two bucket elevators, 23 ft. and 18 ft., c-to-c of pulleys.
15. Storage bins, 5-ton.
16. Belt conveyor on bow gantry to trucks.

FINAL CONCENTRATE is produced in this shore plant. Combined flowsheets use jigs, tables, magnetic separation.

Recovers Placer Scheelite



LEGEND

1. Dredge concentrate, runs about 2% WO_3.
2. Vibrating screen, Hum-mer, ⅛-in.
3. Receiving bin, 50-ton.
4. Feeder, 12-in.
5. Stearns magnetic separator, type K, 3-roll, 20-in.
6. Fahrenwald hydraulic sizer.
7. Fraction: minus 15 mesh, plus 45 mesh.
8. Fraction: minus 45 mesh, plus 65 mesh.
9. Fraction: minus 65 mesh, plus 100 mesh.
10. Four Straub-Overstrom Universal tables: one coarse, one fine, one slime, one middlings.
11. Wilfley sand pump 2-in.
12. Mids. table tailing stockpiled, 5% WO_3.
13. Rotary roaster, oil fired.
14. Bucket elevator, 27½ ft. c-to-c.
15. Stearns magnetic separator, 3-roll, 10-in. type K.
16. Magnetic product, mostly magnetite, but still runs 17% WO_3.
17. Tungsten concentrate, above 60% WO_3, runs as high as 73%.

a way that is unique in my experience.

Our dredge is running on Henderson Creek in the Sapphire Mountain Range about 17 miles south of Drummond, Granite County, Mont. The area has a long history of gold production, its total gold output prior to 1910 was about $1,000,000. Presence of tungsten had been known for some time when we became interested in the region.

Sampling Method

After World War II began, we tested the Henderson Creek area with the purpose of producing tungsten concentrate for war requirements. We sank about 105 caisson shafts on specific crosscuts for the full length of the creek, a distance of 4½ miles. Bulk samples came from each shaft and were washed in a sampling unit that used the same sort of equipment now on our operating dredge.

First the samples went over steel washing boxes with slotted sand traps on the lower ends of the riffled sluices. Concentrates went to a small sample mill and over jigs and tables. The final concentrate was amalgamated, then assayed for its tungsten content. As a result, we could estimate the actual tonnage and gold values in the creek bed on a yardage basis.

The Henderson Creek deposit is about 15 ft. deep, with an average channel width of 400 ft. Water

grade is about 3%. The tungsten occurs as particles of scheelite ($CaWO_4$), derived from a network of small veins in a granite batholith. This granite intruded a Newland lime formation in the Belt series (Algonkian age). It was cut by Henderson Creek at its source.

Mineable gravel is small in size and without boulders, but it is tight in some sections and hard to dig. The bedrock is a clay-like sediment, easily cleaned.

The scheelite particles range in size from 10 mesh to microscopic fineness. Tungsten content is remarkably pure. There are very few penalizing minerals with it. The gold is moderately fine and averages 920 fine.

The early miners referred to worked a Tertiary channel running the whole length of Henderson Creek on its north side about 15 ft. higher than the present creek level. When we found scheelite in the tailings of the old ground sluices, we bulldozed this material over into the dredge channel all along the creek.

Mill Tests Made

After we had estimated the value of the gravel in Henderson Creek, we had mill tests made to work out a proper flow sheet. Tests were made by jig manufacturers and in the laboratories of northwest mining departments.

These tests showed that a low-grade scheelite concentrate could be made on board the dredge without heavy tailing loss. But to raise the grade of the final product to 60% WO_3, a shore plant was required. Tests showed that tabling and magnetic separation could do the job. The operation is now run as indicated in the accompanying flowsheets.

In the fall of 1942, a 3-cu.ft. riffle-type Yuba dredge was brought to Henderson Creek from Elk City, Idaho, 550 miles away. The dredge was entirely rebuilt at the working site.

Its hull, 86x36 ft. originally, was lengthened by adding two 6x6x16-ft. pontoons forward and two 5x6x16-ft. pontoons aft. Purpose was to increase stability.

The main drive motor, for the digging ladder, was increased from 50 hp. to 75 hp. Digging depth is 28 ft. below the water line. We equipped the dredge with 66 new bolted-lip buckets, each having a capacity of 3⅞ cu.ft., against the 3-cu.ft. units formerly used.

Just under the trommel screen, we put sixteen 42x42-in. Pan American placer-type jigs, eight cells to port and eight to starboard, each arranged in four flow-lines of two cells each. These did the rough concentration job.

A 42x42-in. Pan American two-cell jig is used as a cleaner, and a Pan American pulsator jig was added as a final scavenger. Two dewatering drags, two Wilfley sand pumps, a Titan amalgamator, and an oil-fired rotary dryer make up the rest of the flowsheet.

Dredge Like Mill

The deck of the dredge looks like a mill. Every foot of deck space is used. Operation is satisfactory with a day shift of the dredgemaster, winchman, oiler, groundman, and bulldozer operator. On other shifts, the dredge is run by the winchman and one oiler.

We try to keep recovery of WO_3 on the dredge at a maximum. We have plenty of screen area in the jigs for the yardage handled. On the jig beds, we use only enough steel shot to keep the screens covered. The rest of the 4-in. bed is made of hematite.

On the first of each of the two rougher jig cells ("A" cells) we used 5/16-in. shot. We use ¼-in. shot on the second, or "B" cells. We have tried several kinds of jig screens and have settled on 3/16x⅝-in. punched, stainless steel screens on the "A" cells, and ⅛x⅝-in. punched, stainless steel on the "B" cells.

Rougher jigs run at 125 strokes per minute, and the cleaner jig at 160 strokes per minute.

The Titan amalgamator picks up practically all the gold in the cleaner jig concentrate. The remainder, and any quicksilver from the Titan, is caught in the pulsator (Crangle type) jig. The dewatered concentrate is dried as shown in the flowsheet, then elevated by two bucket elevators to a 5-ton storage bin. From this bin, the concentrate is fed through a valve to a belt conveyor hung from the bow gantry. This conveyor discharges directly into dump trucks, filling a truck in about 3 minutes.

The Shore Plant

The trucks take the low-grade dredge concentrate to the shore plant for retreatment. Designed for one-man operation, this plant includes equipment for screening, sizing, tabling, roasting, and magnetic separation. The various units are arranged as shown in the accompanying flowsheet.

Final products are a high-grade scheelite concentrate and a magnetic concentrate that is practically pure magnetite. The dredge product runs about 2% WO_3, but the final product of the shore plant runs as high as 73% WO_3. The established commercial minimum grade is 60% WO_3. Our concentrates are sacked for shipment in 6-ply multiple-wall paper bags which are closed with wire ties.

The magnetic concentrate is now being stored pending shipment to some sink and float plant for use as heavy medium. It is a clean product, nearly all magnetite. During the war it went to shipyards, where it was mixed in with the concrete ballast in naval vessels.

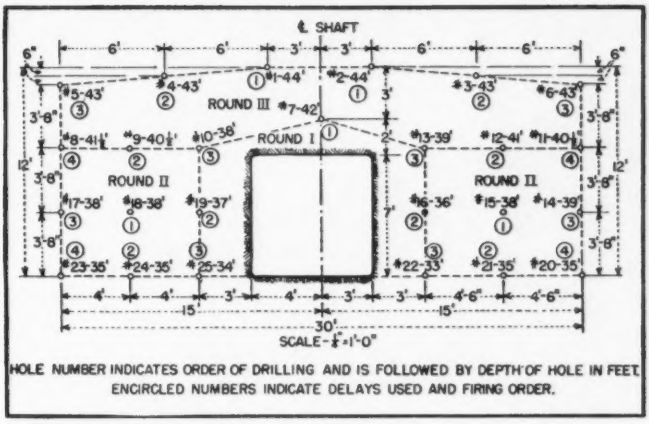
Henderson Creek's flow of water is limited, and during the dry season there isn't enough water to carry the dredging operation. To build up our supply, we repaired two of the ditches used in the 1860's that brought water from Boulder Creek 8 miles south. We built three electric pump stations to boost this water to the head of our water shed. Total hydrostatic head is 430 ft.; pump capacity is 2,000 gpm. We use 16-in., 12-gage slip-joint hydraulic pipe between stations. Power for all uses comes over a 23,000-volt line of the Montana Power Co. between the dredging site and the substation at Mellen, Mont.

Nearly $1,000,000

The Henderson Creek dredge began running on April 26, 1943, and except for seasonal shut-downs caused by 40-below cold snaps, the dredge has run ever since. The WPB's gold mine closing order, L-208, didn't affect us because of our tungsten production, a critical material at that time. We understand that our dredge was the only bucketline dredge in the United States that ran all during the war. At that time, all our concentrate went to the Metals Reserve Co. At present our tungsten production is sold on the open market.

Combined gold and tungsten produced on Henderson Creek since 1943 is nearing a value of $1,000,000. Our monthly yardage is averaging 90,000 cu.yd.

The dredge has been under the same management during this whole period; with myself as manager, W. J. Noon as operating superintendent, James Tabor as metallurgist and engineer, and Victor Griffith as dredgemaster.


℄ SHAFT
ROUND III
ROUND I
ROUND II
ROUND II
HOLE NUMBER INDICATES ORDER OF DRILLING AND IS FOLLOWED BY DEPTH OF HOLE IN FEET.
ENCIRCLED NUMBERS INDICATE DELAYS USED AND FIRING ORDER.

USE OF SHORT-PERIOD DELAYS in shooting this round to enlarge the shaft station gave a clean break, good fragmentation and minimum concussion. A vertical section of face at shaft is shown.

Short-Period Delays Help In Enlarging Shaft Stations

F. W. SAUERWEIN
Mining Engineer

W. HASTINGS
Sterling Mine Superintendent

New Jersey Zinc Co., Ogdensburg, N. J.

EXCELLENT RESULTS were obtained from the use of milli-second-delay electric exploders in conjunction with diamond-drill blast-holes when employed in stripping to size two stations in the new Sterling shaft of the New Jersey Zinc Co. at Ogdensburg, N. J. This five-compartment shaft, driven in metamorphosed limestone, is inclined at 52 deg., with over-all dimensions of 30 ft. by 8 ft.

Set-up Speeds Drilling

In the first instance, it was desired to increase the station height by 3 ft. 9 in. over a width of 27 ft. and a length of 52 ft. Two drill columns, rigged across the shaft and connected by a horizontal bar, formed a rigid set-up which allowed for drilling all holes with a minimum amount of changeover. Six parallel holes were drilled on 5 ft. 5 in. centers with a standard blast-hole machine using EX rods and concave non-coring bits. All holes were drilled to a depth of 54 ft. with an average burden of 3 ft. 9 in., and were carefully aligned and given an extremely slight upward inclination to allow for probable drop of the drill hole.

All holes were loaded to within 2 to 5 ft. of the collar with 1⅛ in.x8-in. cartridges of 40% semi-gelatin powder followed by clay stemming. Explosives were firmed into place by 3-ft. sectional wood tamping sticks threaded with ¼-in. manila rope. Two primers were placed in each hole. One of them was 18 ft. and the other 8 ft. from the collar of the hole.

In using the milli-second-delay electric exploders to detonate the holes, the two center holes were primed with the first delay, and the next outward pair with the second, and the two corner holes with the third delay.

Vibration Negligible

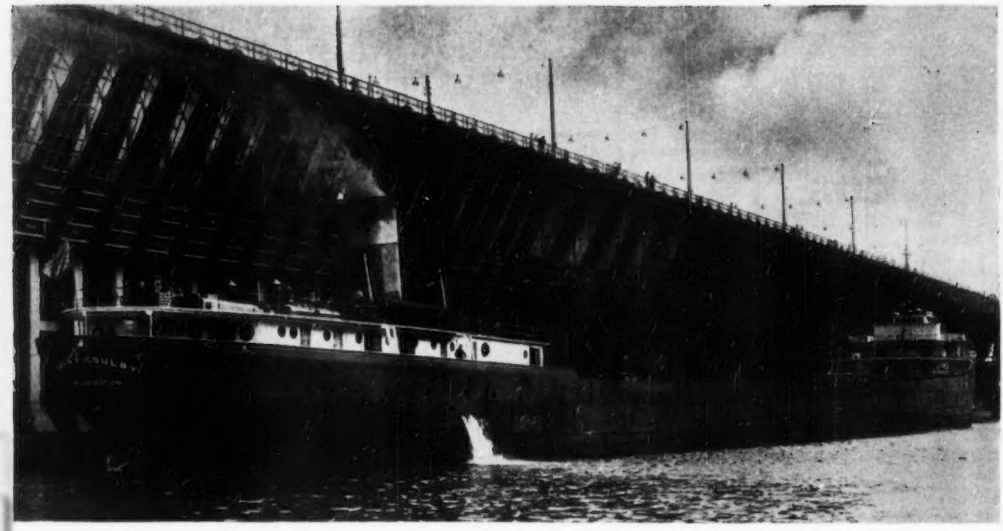
Although 180 lb. of powder was used in the blast, rock vibration was negligible. All holes broke clean, fragmentation was good, and the shattering of back and side walls was at a minimum. All drill holes were discernible in the back after the round was fired, and showed the results of careful alignment. The tonnage broken per foot of hole drilled was 1.42 and the amount of powder used per ton broken was 0.39 lb.

In the second instance, a station was enlarged by the use of blast holes to the full size of 30 ft. wide by 38 ft. long by 11 ft. high from a preliminary 7x7-ft. crosscut driven 38 ft. from the hanging wall of the shaft. Twenty-five holes were drilled parallel to the crosscut from a rig similar to that previously used. Holes averaged 39 ft. in length and were spaced vertically on 3 ft. 8 in. centers. The seven holes immediately surrounding the crosscut were drilled with a 3-ft. burden, while the remaining six on each side were spaced horizontally, as shown in the accompanying drawing at the left. Six back holes drilled 6 ft. apart brought the station to finished height.

To provide sufficient volume of opening for the resultant broken rock, the seven holes adjacent to the crosscut were fired in the first round and the muck was scraped to the shaft. The six outer holes on each side were then blasted and the broken rock was removed before blasting the six back holes that remained.

The loading of holes was the same as before. Milli-second delays from "1" to "3" were used in the first round, the second round was fired with four delays, and the three delays were used in the six back holes of the last round. Some "bootlegging" was apparent in the first two rounds, occasioned by the presence of a mud slip requiring a small amount of cleaning up previous to the blasting of succeeding holes. Fragmentation was excellent and no secondary breakage was necessary. Shattering of side walls and back was at a minimum. The tonnage broken per foot of hole drilled was 1.05, and 0.60 lb. of powder was used per ton broken. In this instance, pounds-of-powder-per-ton was more than in the previous example, due to limited size of the initial opening.

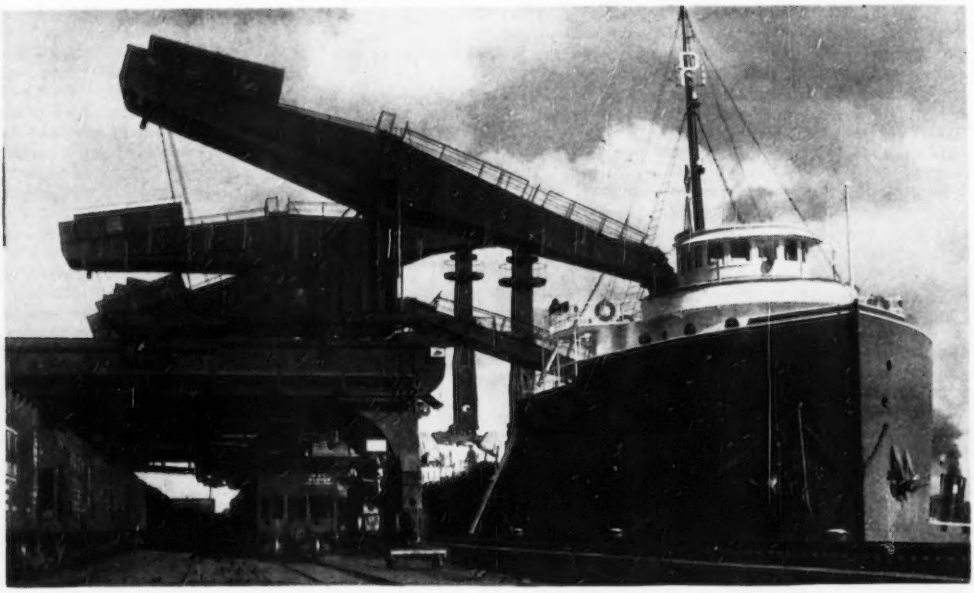
The use of milli-second-delay exploders in conjunction with blast-holes, as demonstrated in these two operations, produced a clean break, satisfactory fragmentation, and a minimum of concussion. It is believed that equally satisfactory results could have been attained by the use of greater hole burdens or a decrease in the amount of powder consumed. In these initial experiments, however, it was desired to insure positive results.



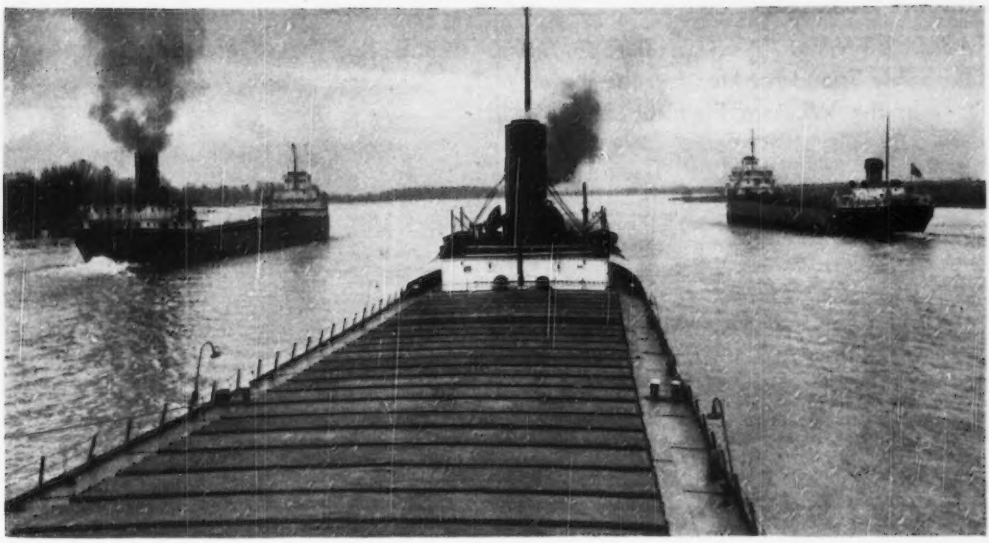
LOADING. A boat gets its cargo at world's largest and fastest ore-loading dock, at Allouez, in Duluth-Superior area. Loading can be done in a few hours. The Harry Coulby has carried almost 17,000 tons in a single load.

Iron Ore Moves

Shipments from Iron Country mines to furnaces are under way again after



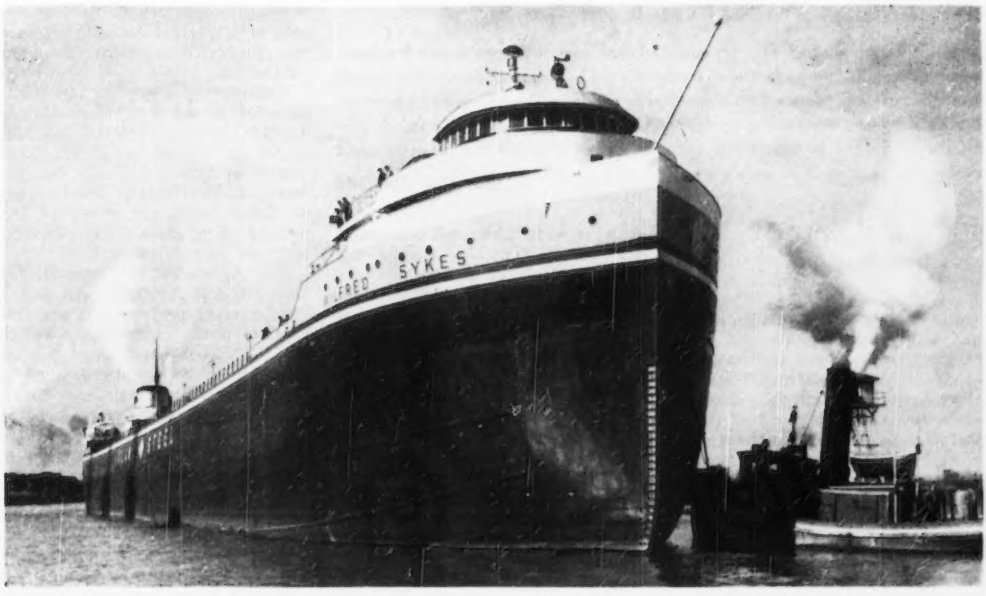
UNLOADING. Here at N. Y. Central, or Union, dock at Ashtabula on Lake Erie, ore is being transferred to cars by Hulett unloaders for shipment to furnaces. The fleet to which this carrier belongs comprises 36 boats.



DOWNBOUND with 10,000 tons of ore, a boat passes between two 13,000-ton carriers in St. Clair river between Lake Huron and Lake Erie. None of the three checks its 12-mph speed in this instance of "close-piloting."

Down the Lakes

winter tie-up of carrier fleets . . . . . Photos by CARL McDOW, Cleveland



LARGEST ORE CARRIER to be built on Great Lakes is Inland Steel's Wilfred Sykes. Her maiden trip was made in April. Capacity is 20,000 tons. At average speed of 16 mph, she should make 44 round trips per season.

TABLE I. What Western Europe Will Probably Spend for Non-ferrous Metals in the Western Hemisphere

(In Millions of Dollars)

Commodity	Fiscal Year 1949/50	1950/51	1952/53
Total Non-ferrous Metals	314[a]	301[b]	245[b]
Aluminum	47	50	41
Copper	117	120	94
Lead	8	11	13
Zinc	17	16	12
Other Non-ferrous Metals	30	22	15
Ores and Concentrates	95	82	70

[a]Based upon world market prices in effect during the first 8 months of Fiscal Year 49/50 and the March average for the period March through June, 1950.

[b]Based upon average world market prices for the month of March, 1950.

TABLE II. These Western European Purchases Have Already Been Authorized by the E.C.A.

Cumulative April 3, 1948-February 28, 1950

Non-ferrous Metal Commodity	Millions of Dollars
Total	595.2
Aluminum and Aluminum Base Alloys	109.5
Copper and Copper Products	247.6
Brass and Bronze and Products	7.0
Lead and Lead Base Alloys	57.0
Nickel and Nickel Base Alloys	6.4
Tin and Tin Base Alloys	2.0
Zinc and Zinc Base Alloys	70.9
Other Non-ferrous Metals (Including Precious Metals)	12.2
Metallic Ores and Concentrates	82.6

Europe Will Need Metals From

A Vital Factor in Future Prices

The prices that domestic producers of non-ferrous metals will receive over the next few years have an obvious relationship to the volume of metal, if any, that will be in distress for a market. Because the world's good mines are going to continue producing under any conceivable circumstances, it thus becomes of great importance to have an idea of what the principal foreign markets for metals are likely to take. (E&MJ, March, 1950, pp. 81-83.)

Mr. Wilcox is probably better qualified than anyone else to size up the European market. Those readers who are interested in prices of non-ferrous metals over the next few years will be interested in his views. The estimates he presents are on the whole comforting to domestic producers. They indicate future purchases by Europe in substantial quantities, even if below the totals reached during the peak of ECA assistance.

THE EDITORS

R. L. WILCOX
Washington, D. C.[1]

BECAUSE THE NON-FERROUS metals are world commodities and their markets everywhere reflect each other (with due allowance for duties, exchange controls, shipping costs, etc.), the amount of these metals to be consumed in the world's second most important market, Western Europe, will have a profound effect on the prices that will prevail in this country.

It is because of the importance of this market factor to the plans of American producers that this study is undertaken, not because of any illusions that I, or anyone else, can accurately predict future conditions beyond a few months' time.

However, information that has been gathered by the Economic Cooperation Administration probably provides the best available basis for a sophisticated guess as to the future of European markets for the next few years.

Accordingly, our estimate of the participating countries' likely total purchases of all nonferrous metals, including their ores and concentrates, from the Western Hemisphere or dollar areas through fiscal 1952/53 are summarized in Table I.

The extent to which the ECA has issued procurement authorizations (approvals of a certain quantity of a class of commodities for financing as part of the European Recovery Program) for the participating countries' purchases of nonferrous metals, cumulative April 3, 1948-February 28, 1950, is shown in Table II. Shipments against such authorizations financed by ECA as reported monthly have been at the rate of slightly better than three-fourths of the total amounts authorized.

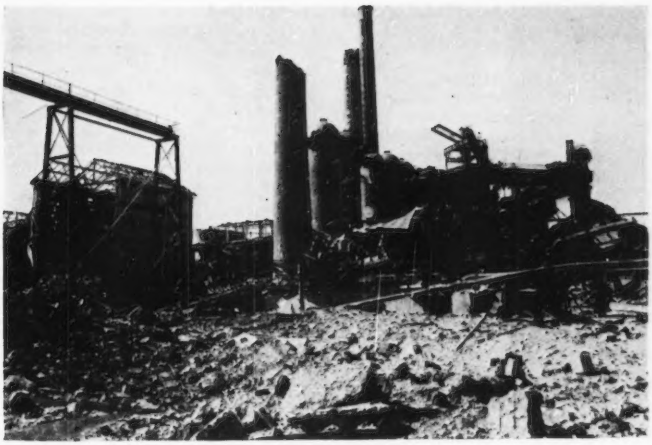
Neither procurement authorizations issued nor paid shipments are directly comparable to the data presented in Table I, as this table merely summarizes likely requirements from Western Hemisphere or dollar areas regardless of the method of providing for convertibility of currencies.

The estimates in Table I for 1949/50 and 1950/51 are based upon current performance and immediate projections. The estimate for 1952/53 is based upon the assumption that consumer demand in the participating countries will continue to show a moderate increase and that planned increases in production will be realized to a corresponding degree.

Consumers Hold Key

However, if consumer demand were to accelerate and planned increases in production were only partially realized, likely requirements from the Western Hemisphere or

[1]Chief, Non-Ferrous Metals Branch, Economic Cooperation Administration, Washington, D. C.



RECONSTRUCTION of war damage like this is still to be done in many European countries. Large tonnages of metal will go into it.

Western Hemisphere

dollar areas in 1952/53 could go as high as $300 million. Or, if consumer demand fails to increase, or decreases slightly, and planned increases in production are almost fully realized, likely requirements might total as little as $200 million.

The participating countries' current rates of production and consumption of aluminum, copper, lead and zinc as compared to the pre-war or 1935-38 period are summarized in Table III for reference purposes only. Net import requirements as indicated by the arithmetical difference between mine production and smelter production and smelter production and consumption are not directly comparable to the data shown in either Table I or Table II, the reason being that net import requirements could be satisfied to a certain degree by purchases from sources such as Australia, Union of South Africa, Yugoslavia, Japan, Spain, etc., where full or partial settlement may be made in other than hard currencies as the result of trade or clearing agreements.

TABLE III. Western European Countries[a] Production and Consumption of Primary Aluminum, Copper, Lead and Zinc

(Unit—Thousands of Metric Tons) Year	Consumption	Production Mine[b]	Production Smelter	Balance Mine-Smelter[c]	Balance Smelter-Con.[d]
		ALUMINUM			
1935-38	197	[e]	186	[e]	— 11
1948	386	[e]	202	[e]	—184
1949	364	[e]	226	[e]	—138
		COPPER			
1935-38	746	360	409	— 49	—337
1948	798	445	524	— 79	—274
1949	795	482	559	— 77	—236
		LEAD			
1935-38	744	245	319	— 74	—425
1948	457	141	220	— 79	—237
1949	440	180	305	—125	—135
		ZINC			
1935-38	640	253	556	—303	— 84
1948	542	225	423	—198	—119
1949	574	259	492	—233	— 82

[a]Countries and their overseas territories participating in the European Recovery Program only.

[b]Recoverable metal content.

[c]Arithmetical difference between mine production and smelter production. Indicates a theoretical net import requirement with no allowance for stock adjustment or the fact that mine production that supplies the smelters is usually augmented by significant tonnages of metal contained in scrap.

[d]Arithmetical difference between smelter production and consumption. Indicates a theoretical net import requirement with no allowance for stock adjustment, etc.

[e]No mine production shown because the aluminum ore, bauxite, is used for purposes other than the production of metal. However, available information indicates that current mine production adequately meets smelter or refinery requirements.

Aluminum. Likely requirements for Western Hemisphere or dollar aluminum by the participating countries in 1952/53 are forecast at about 120,000 to 130,000 metric tons despite substantial planned increases in Germany, France, Italy, Austria and Norway.

This optimism is based upon the current trend toward increased utilization of aluminum in the construction, transportation, communications, and consumer goods industries. Consumer demand by 1952/53 could easily absorb an additional 80,000 to 100,000 MT per year. Because of the inherent high cost of western European aluminum production—with possibly the exception of Norway—as compared to U. S. and particularly Canadian production, it is questionable whether western European production can compete with Western Hemisphere production for the probable marginal requirements of western Europe despite the problem of convertibility of currencies.

Therefore, it is believed that the participating countries will still provide a market for at least 120,000 to 130,000 MT of Western Hemisphere aluminum in 1952/53. Moreover, as Canadian aluminum probably represents the lowest cost production in the world, the western European market for marginal requirements for aluminum will undoubtedly continue to be served by Canadian sources of supply.

Copper. Probable requirements for Western Hemisphere or dollar copper by the participating countries in 1952/53 are forecast at about 225 to 235,000 MT despite substantial planned increases in production in Northern Rhodesia and the Belgian Congo.

Consumer demand for planned

power development programs, reconstruction, electrification and heavy industry could easily absorb an additional 75,000 to 85,000 MT per year or a tonnage about equal to that expected to be provided by increased production in 1952/53.

It is possible that a portion of the small tonnage of primary copper now exported by the participating countries under trade agreements and other necessary commitments could be retained for internal consumption. However, considering the participating countries' current indicated net import requirements for at least 260,000 to 280,000 MT of copper in the form of refined, crude and scrap, it is difficult to see how requirements from the Western Hemisphere or dollar areas in 1952/53 can be much less than estimated.

Lead Use Still Low

Lead. Probable requirements for Western Hemisphere or dollar lead by the participating countries in 1952/53 are forecast at about 50,000 to 60,000 MT despite substantial planned increases in Germany and French North Africa.

Current consumption of lead in the participating countries is still substantially below that of the prewar or 1935-38 period as contrasted with practically complete recovery of consumption of most other nonferrous metals. This situation combined with plans for reconstruction, expansion of communications, automotive and other allied industries would indicate that consumer demand in 1952/53 could readily absorb an additional 80,000 to 100,000 MT per year.

To offset this, there are planned increases in production approximating the likely increase in consumption, the possibility of Yugoslav lead again being available to its traditional market, and probable increased recovery from war scrap. Thus, the estimate of 50,000 to 60,000 MT of lead likely to be needed by the participating countries for marginal requirements from the Western Hemisphere or dollar areas is considered to be realistic.

It will be noted from Table I that estimated requirements for lead from dollar areas increase from 1949/50 to 1952/53 as contrasted with decreases for other nonferrous metals. Normally a decrease could have been expected for lead also. However, in 1949/50 and part of 1950/51 smelter production will be abnormally high because of a temporary greater availability of lead from war scrap.

Zinc. Probable requirements for Western Hemisphere or dollar zinc by the participating countries in 1952/53 are forecast at about 50,000 to 60,000 MT, despite substantial planned increases in production in Germany, French North Africa, the Belgian Congo, and Italy.

Although consumer demand for planned industrial expansion and reconstruction could easily absorb an additional 70,000 to 80,000 MT per year for galvanized products, zinc base alloys and die castings, expansion of smelter production is likely to be limited to the handling of planned increases in local mine production.

Increased mine production in the participating countries by 1952/53 could amount to about 70,000 to 75,000 MT of recoverable zinc per year, which would about offset the probable increase in consumption. However, some additional tonnage of zinc now exported outside the participating countries under trade agreement and other commitments is likely to be retained for internal consumption. Therefore, while the current rate of imports of about 90,000 MT per year from Western Hemisphere or dollar areas will in all likelihood be reduced significantly by 1952/53, it is difficult to see at this time how this rate could be reduced much below 50,000 to 60,000 MT per year.

Other Nonferrous Metals. Likely requirements for "other nonferrous metals," which category includes bismuth, cadmium, cobalt, nickel, precious metals, etc., from the Western Hemisphere or dollar areas in 1952/53 by the participating countries are forecast at about 15 million dollars or half the 49/50 rate.

The reason for this reduction is that the participating countries have definite plans, some already underway, for the increased recovery of certain by-product metals such as cadmium which will reduce substantially their requirements for marginal supplies from outside.

However, very little reduction, if any, is foreseen for requirements for certain metals such as nickel, which is and will continue to be essentially a dollar commodity even though the participating countries' requirements are generally supplied from Canadian matte refined in Norway and the United Kingdom. In this connection, allowance has been made for the probable continuation of sales of nickel from Norway and the United Kingdom to the participating countries on a split (dollar-local currency) basis to reflect dollar cost of the Canadian matte or raw material and local currency costs of refining.

Ores and Concentrates. Probable requirements for nonferrous ores and concentrates from the Western Hemisphere or dollar areas by the participating countries in 1952/53 are forecast at about $70 million or three-fourths of the 49/50 rate.

Admittedly, European mine production of certain nonferrous metals will increase, but not sufficiently to eliminate continued dependence upon the Western Hemisphere for marginal requirements if smelter operations are to be maintained at the level indicated by estimated consumer demand.

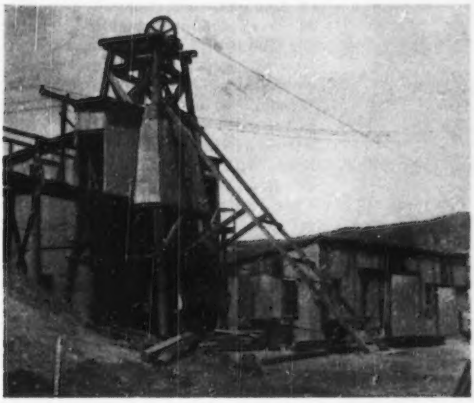
The above applies particularly to ores and concentrates of lead, zinc and tin. In the last case, requirements for Latin American tin concentrates and certain other Western Hemisphere tin residues by the United Kingdom, Germany and others currently at the rate of about $21 million per year are not expected to decrease by any substantial amount.

Requirements for ores and concentrates of certain other metals such as molybdenum, tungsten, etc., may even increase somewhat over the current rate. This would tend to offset possible greater reductions than presently anticipated in requirements for certain "specialty" ores and concentrates for which future demand is virtually impossible to predict with any degree of certainty.

Demand Is Firm

Considering the large share of these materials whose movement is currently being financed by ECA, the reader naturally wonders to what extent these estimates would be upset if ECA activity should be substantially curtailed or eliminated.

To answer this question, one must look at the essential nature of nonferrous metals with respect to the European economy. The curtailment of their use would have such a profound repressive effect on European well-being and progress that I believe the Europeans would deny themselves many other things before foregoing these estimated purchases of nonferrous metals. In other words, I do not believe that changes in the ECA program would greatly affect these predictions.



OZOKERITE from this mine in Utah (it's the only U. S. producer) helps our secretary, and yours, do a better job.

A Mine for Your Secretary

C. W. McCULLOUGH
Park City, Utah

ONE OF THE MOST widely-used products of the mineral industries is also one of the least widely known. Everybody knows, or uses, carbon paper and typewriter ribbons, but few people, even among readers of this magazine, know much about ozokerite or the one U. S. mine that produces it.

Ozokerite is a mineral wax, a hydrocarbon of varying composition, ranging in color from transparent white to dead black. It can be as soft as wax or as hard as gypsum. Once it is properly refined, however, office supply manufacturers need only melt it up, add dyes and spray the melted wax onto the paper or ribbon fabric.

Carbons and ribbons finished with ozokerite don't smudge easily, yield a sharp image with good color, and don't fade or get too hard during storage. That's why the entire present output of the one producing U. S. mine goes into carbons and ribbons, although ozokerite could be used in cable coverings, protective paints, and other uses for inert waxes.

Strangely enough, there are only two known productive deposits of ozokerite. The U. S. has one; Joe Stalin has the other.

U. S. ozokerite comes from the Ozokerite Mining Co., which has for several years been mining an orebody located near an isolated whistle-stop on the D. & R. G. W. in southern Utah named Soldier Summit.

The mineral occurs in vein or fissure deposits much like the orebodies of metallic minerals. Ozokerite differs from the related mineral, gilsonite, in that it is well disseminated through the vein filling. Gilsonite is usually found in masses.

The ozokerite veins are found in widths up to 36 ft. in the sands and shales of the Green River formation. The property is worked to a depth of 600 ft. through two shafts. Known mineralization is now estimated at about 100,000 tons of commercial ozokerite.

The ozokerite veins are vertical or steeply-dipping, and simple square-set stoping is used. Very little waste rock is broken, the only waste now being produced comes from development work around the No. 2 shaft. All ore is hand-loaded into small cars and is trammed to the No. 1 shaft and hoisted in the same cars.

Contrary to the conditions met in mining gilsonite or elaterite, there is no critical fire hazard in the ozokerite mine. This is probably due to the dissemination of the mineral in the gangue. Ozokerite, itself, is flammable and can become explosive through volatilization of gases, but it does not reach a dangerous concentration at any point in the mine.

As a safety precaution, however, all blast holes in the ore are loaded with cartridges of limestone dust along with the dynamite sticks. This automatically limits any flash that might be started by the blast. No disaster from fire has occurred during the life of the mine.

All drilling is done with jackhammers and Timken bits. Whenever a hard rib is struck in the soft ore, the driller uses a tungsten-carbide bit to push through it. To get the very fine breakage desired, 40% dynamite is used for blasting.

The ore is crushed and ground in the mill to minus ¼-in. Concentration is a simple matter of dumping the crushed ore into water. The ozokerite, with a specific gravity of 0.9, floats; the gangue doesn't. The ozokerite concentrate has a melting point, depending on composition, of between 58 and 100 deg. C. It is heated to that point, blended with various vegetable waxes and high-grade paraffins to meet the specifications of the trade, and then packed into 400-lb. drums for shipment. The entire refining process is carried out right at the plant near Soldier Summit.

The property was worked during the first World War, and has been in continuous operation for the last ten years. To meet the growing demand for ozokerite, an extensive development program is now underway.

Most of the mine's output is used in the United States, but substantial shipments have lately gone abroad. These markets could be expanded greatly if the mine could increase its present output much beyond the requirements of the domestic market.

Photo by Carl McDow, Cleveland

THE WELLAND CANAL permits 25-ft. navigation between Lake Erie and Lake Ontario instead of 14-ft. navigation formerly provided. Its construction was begun by Canada in 1912 and finished since then. It is a link in Great Lakes-St. Lawrence system.

Labrador Iron Ore and the St. Lawrence Seaway

W. H. DURRELL
General Manager
Hollinger-Hanna Limited
Montreal, Que.

IRON ORE WAS discovered in Labrador in 1929, but it was not until seven years later that a Montreal mining man formed Labrador Mining & Exploration Co. At this time, a 20,000-sq.mi. concession was acquired in Labrador, and in 1939 a Quebec license was obtained covering 3,900 sq. mi. adjacent to the Labrador concession. Hollinger Consolidated Gold Mines Ltd. entered the picture in 1942 by acquiring control of Labrador Mining & Exploration Co. and Hollinger North Shore Exploration Co., Ltd., was formed to operate in the Quebec area. The same year, the M. A. Hanna Co. became associated with Hollinger as a partner in the venture. Extensive drilling to outline the orebodies did not start until late in 1947.

In 1949, Iron Ore Co. of Canada was formed for financing the development further. In it, five steel companies—Republic, National, Armco, Wheeling, and Youngstown Sheet and Tube—joined with Hollinger-Hanna and the two concession companies to prepare for commercial production. Another new company, Hollinger-Hanna, Ltd., equally owned by Hollinger and Hanna, was formed to supervise management of the operations.

Iron Ore Co. of Canada has been given the right to lease, under certain conditions, a large part of the reserves in both concessions, the underlying concession companies retaining ample reserves for the Canadian steel industry and for exportation to England and Europe.

A large part of the concession area is favorable to the deposition of non-ferrous metals, but the bulk of it is good prospecting ground for iron ore. The importance of our iron ore area will be made clear by comparison to the Mesabi. On the Mesabi, the area of favorable rock is 110 mi. long and 1 to 5 mi. wide, with a productive zone about 70 mi. long. On our concessions the area of favorable rock, the Labrador Trough, is 225 mi. long and 10 to 60 mi. wide. In Quebec-Labrador, exploration has disclosed a productive zone 90 mi. long, with good chances of being extended at both ends. The Mesabi is covered generally by thick overburden, and the deposits were found by test-pitting and systematic test-drilling. In Labrador and Quebec, we have to date developed 358 million tons of high-grade, direct-shipping, open-pit ore from a few surface deposits. When it is considered that at least 95% of the area is covered by overburden and thousands of square miles of favorable territory remain to be explored, the possibilities for developing additional ore are seen to be tremendous. Within a radius of a mile or two of our base camp at Knob Lake there is 200 million tons.

Last summer, when bulldozing roads to some of the known surface deposits, high-grade ore was uncovered in places a foot or two below the surface. These might develop into considerable tonnages, but we have not had time to investigate them. Another instance occurred when a new drill was set up to be tested and which cut ore after drilling 2 or 3 ft. The hole was continued to 367 ft. and was still in high-grade when stopped. This was the only deposit drilled which was not discovered as a surface outcrop.

We will be able to supply almost any type of ore, ranging from lump to highly manganiferous. Of the latter, 44 million tons will average 50% iron and 8% manganese.

The Projected Railway

To haul the ore to tidewater will require 360-mi. railway, running from Knob Lake to Seven Islands, where there is a good deep-water port for large ocean-going freighters. Preliminary surveys have been completed for the entire route, and sufficient location to permit an accurate estimate of the construction cost.

Leaving Seven Islands, the railway for 100 miles will follow the Moisie, Nipissis and Wacouna rivers to the "height-of-land" at 1,900-ft. elevation. The remaining 260 miles are nearly level, and con-

•Condensed from an address before the Ohio Valley Improvement Association, at Pittsburgh, Pa., March 30, 1950.

struction will not be as difficult as that in the Pittsburgh area. Maximum grade against the load will be 0.2%. Three to four years will be required to complete construction.

To build the railway will require approximately $50 million for roadbed, and an additional $50 million for rolling stock and other requirements. Harbor facilities and ore docks at Seven Islands will cost about $15 million.

Mining will be the least of our problems, as it will be entirely by open pit, with a very low stripping ratio. The season will be limited to the six summer months to eliminate the possibility of ore freezing in transit. We will be mining and hauling 60 to 70 thousand tons per day during the season. We plan to haul 10 to 12 thousand tons per train, using diesel-electric locomotives.

We also plan to stockpile 2 million tons at Seven Islands to extend our shipping season. The port is free of ice for at least nine months, and some experts say that it could be operated for the full 12 months.

No Problems

Contrary to a reference made to our project in a recent article in connection with new South American discoveries, there are no problems in respect to mining and transportation to Seven Islands. The railroad will not traverse 400-500 miles of tundra, but the project will be one of a normal railway construction similar to the 53,000 miles of railroad already built in Canada. Neither will there be a problem as to labor. We are in an unique position in that respect. We will be working near an area where there are extensive pulpwood-cutting operations throughout the winter, with very little work for these men during the summer. More of this type of labor will be available than we will be able to use. The same applies to railway personnel. During the summer, when we will be hauling most of our ore, there will be a large number of railway men upon whom we can draw, as heavy railway employment in Eastern Canada occurs after the close of navigation on the St. Lawrence.

The climate in this area is no more rigorous than in Northern Ontario, and differs but little from that of the Minnesota ranges. Most of the hills are bare but the valleys are well wooded, and plenty of timber will be available for building and mining.

In terms of latitude, Knob Lake is less than 100 miles north of Edmonton, which is in the heart of the new Alberta oil fields.

Hydroelectric power for mining is available from an excellent site within a reasonable distance of the ore deposits. Our present requirements are small, but there is a potential of 3,000,000 hp. in the area.

I have described our future transportation. I should emphasize that the development of this entire project would not have been possible without air transportation. We have our own air transport company and operate seven aircraft.

Seaway Will Aid

Our overall capital expenditure will be about $200 million. This will provide for power developments at Seven Islands and Knob Lake, townsites, mining equipment, railroad and rolling stock, harbor and transportation facilities, and other requirements. To insure a fair return we would have to mine and ship a minimum of 10 million tons per year. We hope eventually to increase production to 20 million tons a year, as ore is required and if construction of the St. Lawrence Seaway is undertaken. Neither the present canals nor the fleet of "canallers" can carry more than a fraction of 10 million long tons. (The industrial development of the United States has been facilitated by the ease with which Lake Superior ore could be brought to the furnaces via the Great Lakes system.)

Canada and the United States have been considering the improvement of the Great Lakes-St. Lawrence navigation system for navigation for many years. In 1912, Canada undertook to build the Welland Ship Canal, since completed, which permits 25-ft. navigation instead of the 14-ft. navigation formerly provided between Lake Erie and Lake Ontario.

The situation now is that the St. Lawrence-Great Lakes route provides 30-ft. navigation to Montreal, 14-ft. navigation between Montreal and Prescott, and 25-ft. navigation above Prescott. Consideration is being given to modernizing that portion of the waterway between Montreal and Prescott, which has not been improved since 1900, to take advantage of the facilities already existing above and below this bottle-neck.

It is estimated that, with a canal system from the Great Lakes to Montreal, the carrying capacity of such a waterway with single locks and modern vessels would be approximately 40 million tons. This could be increased to 80 million per annum by providing duplicate locks when the necessity arose.

Joint development of power and navigation in the stretch of the river between Prescott and Montreal would permit the provision of an additional 3 million horsepower, now badly needed.

The Seaway is not the billion-dollar project that it is commonly called. Based on a report issued by the General Engineering Branch of the Canadian Department of Transport, dated June, 1949, the estimated cost of completing the waterway, as applied to navigation only, is $350 million. Opponents of the project are prone to use the billion dollar figure, but that includes all power projects in connection with the over-all scheme, improvement of harbors in the Upper Lakes area, and many other items that have no bearing on the actual cost of the canals and locks between Montreal and Lake Ontario.

The Canadian Government has signified that it is most anxious to proceed with this work. The green light from Washington is awaited.

Important to U.S. Industry

As to the future, it has been suggested that eventually the center of gravity of the United States steel industry will shift to the Atlantic coast. The only compelling grounds would be cheaper production of steel from imported ores. . . . It seems fair to conclude that, with Labrador ore available at reasonable cost to inland steel plants through construction of the Seaway, there will be no precipitate shift of the steel industry to the coast, and indeed it may never occur. Quite apart from cost factors, coastal plants depending on waterborne imports of ore would be extremely vulnerable in wartime. Such imports were a casualty of the recent war, and millions of tons of ore had to be shipped overland to the coast from Lake Superior ranges. Shipments from Labrador, moving along the St. Lawrence from Seven Islands to the Great Lakes, would be relatively easy to protect.

The iron ore is in Labrador-Quebec. It will be of immense value to Canada. It can be of immense value to the United States. If an emergency should arise, all of North America will appreciate the advantage of having a large reserve of high-grade iron ore on home grounds.

NEWEST PRODUCER of asbestos in Thetford district is Flintkote Mines, Ltd. Open-pit mine, here seen two years

IN HEART OF THETFORD DISTRICT. From left to right, this panorama, taken over a 180-deg. arc,

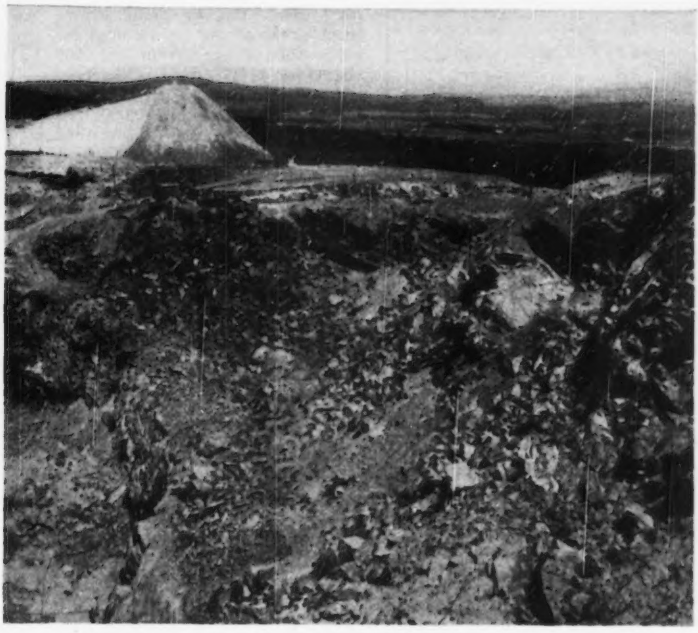
Asbestos Industry Strives to Meet

W. A. RUKEYSER
Consulting Engineer, New York

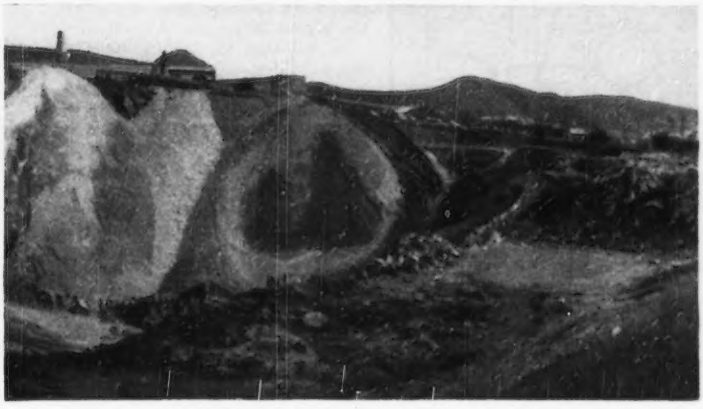
THE QUEBEC ASBESTOS industry seems to have reached the stage where a considerable increase in fiber output is necessary. A previous article* pointed out the increase in production, caused by an expanding economy, of the older asbestos manufactures such as brake lining, clutch facings, packings, pipe covering, and roofings. It likewise cited the greatly expanded demand for asbestos-cement products, including flat and corrugated sheets, pipe, and shingles. Above all, it stressed the more recently created demand for the shortest grades[1] arising from the development of new products, especially for asphalt tile and in plastics.

This demand is being met by ex-

*"New Uses for Low-Priced Fibers Vital to Canadian Asbestos," W. A. Rukeyser, *E.&M.J.*, March, 1950.



after mill (at left) started, was developed by company "from grass roots."



shows backfill of King and Johnson mines, with open-cut mine of Bell in foreground.

Increasing Demand

pansion of present plants; by opening new ore reserves and worldwide search for other deposits; and by experimentation with new techniques, particularly in beneficiation. These new developments are the subject of this article.

However, development of a new asbestos deposit does not depend on the mere finding of ore reserves having sufficient fiber content. The fiber must be commercially adaptable to the highly competitive manufacturing processes involved in the production of asbestos products. Not only does the chemical composition of the asbestos enter into its suitability (particularly the iron and other impurity content, water of crystallization, percentage of magnesia, lime and silica), but physical properties also are of prime importance. The latter include tensile strength, length of fiber and its degree of "harshness" or "silkiness." For making paper, millboard, shingles, and sheets, for example, the drainage and filtration rates of the fiber must be taken into account, and, in other processes, such characteristics as absorption, wetability, impact strength and surface area.

Hence, the development of new asbestos properties not only must be guided by the usual economic factors applying to any new mining venture, but also must have as a *sine qua non* the suitability[2] of the fiber for established manufacturing procedures, i.e., its salability. Similarly, the new techniques of extraction and fiberization must be guided by the same consideration.

Quebec Facilities Expanded

All companies now producing asbestos in Quebec have added more screens and suction facilities to increase the output of the short fibers, a good part of which previously had been sent to the dumps. The Johnson's Co. has erected a wet-process plant for retreating tailings.

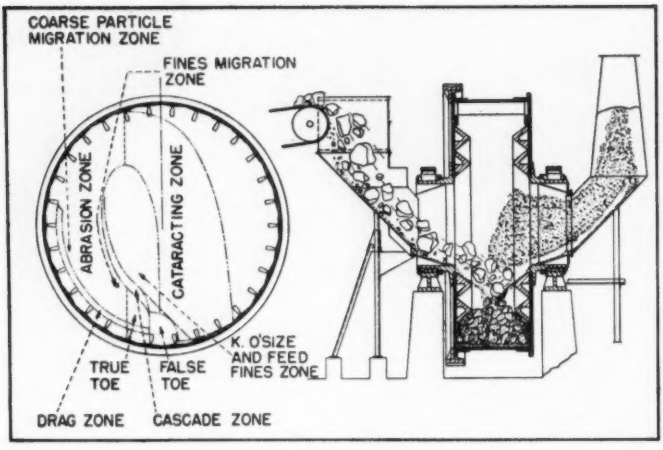
Asbestos Corporation Ltd.[3] has just completed modernizing its British-Canadian property at Black Lake. The crushing and drying plants have been enlarged, and a 48x60-in. deep-frame Birdsboro-Buchanan jaw-crusher has been installed in the new building completed in the spring of 1948. Two stack driers have been added and a new primary mill built for extracting long fibers. The milling facilities previously used now serve as the finishing end of the flow-sheet. An American Wheelabrator dust-bag unit has been installed to handle exhaust air from both the new and old sections of the mill. The extension will eventually increase capacity from 3,000 to 4,800 tons of rock per day.

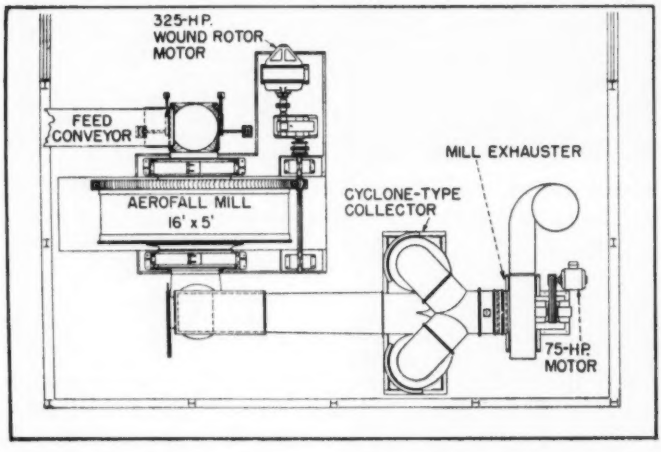
In the mine, truck haulage has replaced rail transportation. Euclid trucks with 25-ton, quarry-type bodies are being used. A new

[1] "Asbestos Fiber, Shorts and Floats—Their Uses in Industry." Canadian Johns-Manville Co., Ltd.

[2] M. S. Badollet, in the C.I.M.M. *Bulletin*, April, 1948, "Research on Asbestos Fibers" describes in detail how the different properties of asbestos affect its usability.

[3] Personal communication from George Jenkins, general manager and director, Asbestos Corporation, Limited.





AIRSWEPT AEROFALL MILL, shown at bottom in plan, has been tested at Bureau of Mines at Ottawa by author as well as two major Quebec producers in runs on larger scale. Discharge is effected by suction (at right) with resulting air classification. Above at right, the vertical section shows ore entering mill and the fine crushed product leaving by means of suction. To the left of it the longitudinal section shows the different zones inside mill. From paper by D. Weston, AIME meeting, Columbus, Ohio, Sept. 28, 1949.

4-cu.yd. P. & H. shovel has been added. Drilling on the old Black Lake Asbestos & Chrome property, adjoining the British-Canadian, has added to this unit's ore reserves (37,072,000 tons, Dec. 31, '49).

At the Corporation's Beaver mine, at Thetford, the diversion of 2 miles of Quebec Central Railway mainline is finished. Relocation of the track to the east now permits the extension of open-pit mining, more particularly by the joining of the new Sharpe pit with the old Beaver-Jacobs Consolidated-Bennett-Martin. The Beaver also is replacing rail by truck haulage. A filtration unit has been added to the mill for dust removal.

Additional diamond-drilling has been done on the idle Maple Leaf property of the Corporation. This adjoins the Beaver on the southeast. The ore reserves are being conserved for Beaver mill feed.

Ore at 1,700 Ft.

At the King mine, also at Thetford, further exploration is being vigorously prosecuted. Asbestos-bearing serpentine has been indicated to a depth of 1,700 ft., the deepest in formation in the district. At present, the ore being drawn from blocks at the 900-ft. level exceeds that drawn from the 500 (52% vs. 48%). This is the only mine of the Corporation that uses block-caving, some 14,500,000 tons having been mined by this method prior to 1949. At the Corporation's other mines, all ore comes from open-pit workings with the exception, in 1949, of 9 per cent of the Beaver mill-feed, which was produced by glory-hole.

In 1948, the Asbestos Corporation stripped 601,152 cu.yd. of overburden, handled 685,432 tons of barren rock to waste, and mined 3,145,326 tons of mill-rock in addition.

Improvements were made in the mills at Vimy Ridge and the King, and in the drier installations at the Beaver and the Vimy Ridge.

Chief among the Asbestos Corporation's exploration programs has been the intensive diamond drilling of a new orebody at Vimy Ridge. This has been located under heavy overburden and closely drilled to 900 ft. in depth. It has shown (Dec. '48) 12 million tons as "proven" ore with an additional 23,000,000 tons "indicated." Further work is being done to confirm the higher figure.

In addition to performing diamond drilling and exploration work on its large acreage in the Black Lake-Thetford-East Broughton district, the Corporation intensively tested a chrysotile occurrence in Newfoundland. This work has been discontinued.

Johnson's Co.[4] has developed a new orebody, in actuality the northeast extension of its old one, at Black Lake. A new pit was opened in 1946-7. Diamond drilling has revealed large reserves of high-grade ore under easy conditions of overburden. In 1947 alone, 15,000,000 tons was shown by 27,859 ft. of drilling. Rumors are current in the district that the erection of a 3,000-ton mill at Black Lake is being considered.

Block-Caving Here Also

Johnson's has continued development of block-caving methods at Thetford, having produced about 5 million tons by this method prior to 1949. Studies have been made to determine whether grizzly drifts should be replaced by "haulageways," 6 ft. wide by 8 ft. high, the ore to be drawn by scrapers. The shaft has been deepened to permit

[4] "The Mining Industry of the Province of Quebec in 1947," Bureau of Mines, Province of Quebec.

development of a second series of lower blocks.

Bell Asbestos Mines Ltd. continues to prepare for block-caving, its open cut having reached a depth of about 350 ft. (see cut, pp. 94-95). A shaft has been equipped for this purpose. Additional screens have been installed in the mill to permit recovery of greater quantities of shorts. Capacity is said to have been increased to 1,800 tons of rock per day and further increases in output are being considered.

Also at Lac Frontier

This company has explored properties other than its own by drilling on options near Sayabec in Matapedia County, at Lac Frontier, as well as in the Thetford district. On one property, Lots 15A and 15B, Range IV, of Thetford Township, extensive drilling and bulk-sampling have developed a large body of commercial ore over a length of 2000 ft. and a width of 800. Drilling has been limited to a depth of 300 ft. The asbestos content is high and the fiber of excellent quality. The grade has been confirmed by milling 800 tons of bulk samples in the company's plant at Thetford. Over 30 million tons has been developed to date on this property, which has been purchased outright. Exploration work has also been done in Maine.

Canadian Johns-Manville[5] at Asbestos, Que., continued its preparations for block-caving. The blocks will be 200 ft. on a side. The shaft was sunk to 1001 ft. depth in 1948. A main haulageway, circular in plan view, has been opened at the 750 level. Ore will be delivered to the underground crushing plant at the 816 level, the loading station being at the 950, with provision for a 125,000-gal. sump. The cage will accommodate 56 men. Two 200-cu.ft. skips are being installed.

At the mill, facilities to produce more short fibers have been installed and the dust problem is now under control, through use of a Cottrell plant reputedly costing over $100,000. Dust is removed from the system to a special dump outside the town. Otherwise, the only principal construction work done at Asbestos, Que., recently has been the provision of a new 60,000-ton dry-rock storage providing about 10 days' mill supply. This facility permits "seasoning" the ore before milling (equalizing temperature and moisture conditions). The mill-rock also can now be bedded. By filling horizontally or diagonally and reclaiming vertically, the ore for several days' supply is mixed. This results in a steadier production of the various mill grades.

[5]Stockholders' News, Johns-Manville Co., May, 1948, *et al.*

Diamond Drilling by Asbestos Corporation in 1948*

King mine (underground), ft.	15,748
Beaver mine, ft.	1,839
British-Canadian mine, ft.	7,409
Vimy Ridge mine, ft.	29,275
Other properties, ft.	64,371
Total for 1948, ft.	118,642

Ore Reserve Estimated as of Dec. 31, 1948

King mine, tons		10,024,000
Beaver mine, tons		12,410,000
British-Canadian mine		38,988,000
Vimy Ridge mine		
Present workings, tons	7,105,000	
New body, proven, tons	12,000,000	
New body, indicated, tons	23,000,000	
		42,105,000
Other properties		7,300,000
Total, tons		110,827,000

*Asbestos Corporation Limited Annual Report for 1948.

A Find Outside the Province

The major development of new production facilities, however, is not at the main Johns-Manville property in Quebec. In complete secrecy during 1948-9, the company opened a new mine near Matheson, Monroe Township, northern Ontario. This is on the provincial-government owned Ontario-Northland Railway, 45 miles north of Kirkland Lake.

The Ontario fiber is reported to be of unusually good quality. An orebody has been outlined by diamond drilling to a depth of about 800 ft. over a length of 4,200 ft. with a width of 500 to 1,000 ft. Further details will be given elsewhere.

Both Nicolet Asbestos Mines and the Quebec Asbestos Corporation are actively trying to find new mines. The latter has considered properties in the Thetford district and in Matapedia County. More recently, in 1948, it acquired substantial holdings in the new Ontario field east of the Johns-Manville property. It is rumored that the former Asbestos Mines Ltd.'s mine of the Asbestos Corporation at East Broughton has been leased to Quebec Asbestos, the ore to be milled in the present plant a mile away.

Newcomer Near Thetford

The most recent newcomer to the Thetford district is Flintkote Mines Limited. Late in 1944 the author examined for the parent company and acquired Lot 18, in Range IV, Thetford Township. The property lies on the Pennington dyke, a little over 2 miles as the crow flies from Thetford and half a mile southwest of the former workings of the old Pennington mine (now owned by Asbestos Corporation).

A new 750-ton mill started operating in June, 1946. Since then its capacity has been increased to 900-1,000 tons of rock per day.

Exploration Intensive

Not only are the established producers searching for new properties in the Thetford district and elsewhere, but the growing demand for fiber has stimulated outsiders and new companies to do likewise. One, the Potash Co. of America, did some reconnaissance in 1948-49 but has since withdrawn from the district. Most important among the new prospects is probably that of the United Asbestos Corp. Ltd., organized early in 1948 to take over several properties, the mining rights of which had remained open and been staked by one of the company's founders. Most of this company's properties lie in Thetford, Coleraine and Wolfestown townships. Financing was by public issue of shares.

The property on which drilling to date has been most successful consists of 460 acres under the bed of Black Lake. It has been drilled primarily on the southern side of the lake near the Sherbrook-Quebec City highway. The "A" orebody, as now outlined, covers roughly an area 3,600 ft. long by 550 ft. wide and has been drilled to 737 ft. depth. Report states that there is a central 300-ft. section comprising a series of granitic intrusions alternating with highly altered but almost barren serpentine. The rest of the area drilled and its western extension reputedly carry a tonnage running into some tens of millions of rock, varying considerably in content, however, from hole to hole and at different horizons.

Draining the lake appears to be impractical and there is up to 270 ft. of silt in its bed. Therefore, a mine developed at this location would probably have to be worked by underground methods. A 500-ft. shaft has been collared a short distance from the shoreline at a point

where the water is about 1½ ft. deep and the lake bed averages 28 ft. of sand and gravel.

Public Financing Helps

Two other companies which have been developing properties with funds raised by public financing are the International Asbestos Co. Ltd. and the Continental Asbestos Co., Ltd. By the end of 1948, the former had put down 64 diamond-drill holes and driven 1,500 ft. of tunnel. It is reported that fiber lengths up to ⅝ in. have been revealed but that the major portion of the orebody contains shorter fibers on the order of ¼-in. and below (Groups 4, 5, 6, and 7). The property consists of 600 acres, about 35 miles west of Thetford and 12 miles east of the Johns-Manville holdings at Asbestos.

The Continental Asbestos Co. has been exploring the old Paré property, from which 200,000 tons was mined between 1922 and 1929 by Asbestos Quarries Limited, a predecessor company. This property comprises Lot 105A situated about 1½ miles from Coleraine, 10 miles southwest of Thetford Mines on the Quebec Central Ry.

Another property, recently developed, on which at least a medium-tonnage mine has been indicated by diamond drilling, prospect shaft and drift, is that owned jointly by Asbestos-Cement Associates, Inc., of Millington, N. J., and J. A. Jacobs, of Montreal. Several million tons under an average of 27 ft. of glacial drift has been developed showing commercial grade with fiber of excellent quality in Groups 3 through 7. A considerable portion is yet to be explored. It contains nearly 200 acres and adjoins Johnson's Black Lake to the south, the Beaver mine, of the Asbestos Corporation, to its north, and the old Maple Leaf on its east.

In Quebec, where the serpentine massif outcrops northeast of the Chaudiere River and 35 to 40 miles from the most northerly producer at East Broughton, the St. Lawrence Asbestos Co. has been developing a new find, which shows promise. Asbestos-bearing serpentine occurs over an area at least 500 ft. wide by 1,800 ft. long. Some veins of crude and Group 3 fibers have been observed. A small fiberizing plant capable of handling possibly 15 tons of rock per day began operation in February and is working on sorted, partially pre-cobbed ore. Plans are being made for more active, larger-scale development.

The important deposits developed by Canadian Johns-Manville in Monroe Township, Ontario, have been mentioned. The Foundation Co. Limited, as general contractor, began construction of a mill, shops, and other buildings last fall. By November, steel work had been started on the main mill building. Capacity originally planned was 50 tons per hour, but this has been stepped up so that two units will have a combined capacity of 100 tons. Provision has been made for a subsequent increase to 400 tons per hour. The flowsheet will follow standard Quebec practice. Storage capacity for dried rock sufficient for eight days' mill operation is being provided. The plant is expected to be placed in operation by May or June of this year.

The chrysotile asbestos that occurs here is primarily of a harsh variety, quite similar to that of Vimy Ridge, Que., much in demand as a premium fiber for making asbestos-cement products.

Although Canadian Johns-Manville appears to have the greater part of the favorable structure along the serpentine belt, the Quebec Asbestos Co., owned by Philip Carey Co. of Cincinnati, is also active on substantial holdings. Apparently a new and important asbestos district is in the making.

Asbestos in Vermont

Vermont Asbestos, owned by the Ruberoid Co. of New York, has recently completed a new mill of approximately 2,000 tons daily capacity on its property near Hyde Park, Vt. This company, with its predecessor, has been mining in this vicinity since World War I but on another deposit nearby. These orebodies lie just south of the Quebec border and occur as a southerly extension of the Quebec deposits. The asbestos is predominantly of the slip-fiber type and comprises mainly Groups 4 through 7.

New Techniques

Prospecting. Only since the war has geophysics been applied to the search for additional asbestos potential. Chrysotile, in the most important of the world's deposits—in Quebec, in Rhodesia, in the Urals, and in the newly discovered and possibly large district in Morocco, invariably occurs in a serpentine host-rock derived from ultrabasic massifs. Minor deposits such as those in Arizona, the Carolina district of South Africa, and in Asiatic Russia, are in serpentine derived from limestone. The serpentine derived from within ultrabasic rocks usually are highly magnetic due to appreciable quantities of contained magnetite. Hence the land- and airborne magnetometer finds ready application to delineating favorable areas for prospecting. In addition, other geophysical methods also can be used to determine the more highly brecciated zones which form favorable loci for asbestos deposition.

An airborne magnetic survey was made of the asbestos occurrence south of Spencer Lake in Maine in 1948, some 1,200 sq. mi. having been so explored with conspicuous success.[6]

Mining. Power shovels are almost universally used in Quebec wherever the depth of open pits still permits. However, the application of block-caving should assure the life of the Quebec deposits for at least another generation, though rising costs must be expected.

Where Asbestos Caving Differs

The essential differences in the ore usually caved in the Quebec district (for which modifications of the method must be and have been created), as contrasted to the approved practices in the "porphyries," is that the asbestos rock is harder and that, while fragmentation is adequate, it is not sufficient to eliminate the production of large boulders. More work has to be done at the draw-hole, therefore, and the daily production per block is comparatively reduced. Moreover, serious delays in many draw-holes interfere with systematic caving. More care also must be taken to permit a high recovery and prevent undue dilution, although the place value of the asbestos rock is usually higher than that of, say, the porphyry coppers. Furthermore, steel or concrete only can be used for all mine supports inasmuch as any possibility of contamination by wood splinters must be entirely eliminated. Finally, it is usually necessary that several blocks be in production at the same time to permit fiber production which will meet market requirements and to permit a blending of the mill feed.[7]

Milling. Reference has already been made to a wet-process plant recently completed at Thetford for retreating tailings. Although the wet process was developed directly after World War I by Selective Treatment Co., Ltd., under patents

[6] "Airborne Magnetic Survey in Maine, Patrick M. Hurley, *E.&M.J.*, August, 1949.

which have now expired, the process never before reached the stage of commercial production, although a 1-ton-per-hour pilot plant was operated for several years testing various ores of the Thetford district.

The process is said to eliminate certain disadvantages inherent in the present orthodox treatment. These are:

1. Creation of large amounts of dust which contaminate the asbestos and may be unhealthful to the mill men. 2. Undue attrition of the fiber resulting from dry grinding which, in turn, produces a certain amount of unavoidable breaking-down of fiber length with attendant reduction in value. 3. A higher rate of machinery depreciation. 4. Necessity for providing drier capacity to accommodate the entire mill-feed tonnage. 5. Reduced extraction from the rock milled, due to limitations imposed by air suction at that water gage at which rock particles in excessive amounts are drawn into the collectors along with the fiber.

For the wet process therefore the following advantages are claimed: Preservation of fiber length; increased extraction; decreased cost of operation, particularly in respect to maintenance, drying, and power; also decreased industrial hazards and cleanliness of fiber.

The disadvantages, on the other hand, appear to be: Higher investment required; necessity for protection from freezing; more costly tailings disposal; and some doubts as to whether or not the fiber produced is as acceptable for all market requirements as that produced by dry milling.

The Aerofall Mill

In July, 1948, the author initiated experiments at the Dominion Bureau of Mines in Ottawa to test the airswept Aerofall mill on asbestos ores. An experimental unit, 5 ft. in diameter by 2 ft. long, connected to a collector and Multiclone is available there for pilot-mill tests. As now developed, the mill is a dry, combined crushing-grinding unit taking lump-size feed (up to minus-18-in.) and reducing it in a single operation to as fine as 99% minus 325 mesh. In asbestos milling, where a coarse grind is required, it is capable of producing a product in the 10-mesh range. The discharge is effected by suction with resulting air classification, and, inasmuch as the complete unit is held constantly under a partial vacuum, no dust-control system is required.

The manufacturer states the milling action results from: Comminution by abrasion; crushing through blow impact; crushing through free-fall impact; and crushing and attrition through drag.[8] Theoretically and from actual test-runs it appears that the Aerofall holds interesting possibilities for the treatment of asbestos rock.

Since the 1948 tests, many larger scale runs have been made by two of the major Quebec producers. Although the details of the results are not here available,[9] in general it can be said that the use of the airswept principle incorporated in the Aerofall mill permits removal of the fiber at the instant of its release from the enclosing gangue. The result is the upgrading of the fiber so produced by 25 to 40%. In fact, in fibers over ½ in. long the increase has been as high as 200%, while in overall plus 10-mesh fiber, the method has shown an increase of 30%. Even in the case of minus 10-mesh shorts the output has been in some cases almost doubled.

A Simpler Practice

Should the Aerofall mill be used in asbestos milling, it would probably take as feed the discharge from the primary crusher (set to as wide an opening as possible). It would then, in one operation, accomplish the work now done by secondary crushers, tertiary cones, and four or five stages of the hammer-mill-like "jumbos."

In the tests which I conducted, the products drawn into the collector and Multiclone direct from the Aerofall mill required merely screening with suction and recleaning of the separated fiber. Fiberization, to any degree desired, followed along with a final dusting and grading.

Such a flowsheet apparently results not only in the extraction from the rock of a higher percentage and a longer fiber than obtained by orthodox methods, but also in greatly lessened chance of over-milling. The place-value of the rock was substantially increased. On the other hand, it appeared that not only would capital costs be decreased and smaller floor-space be required for any given capacity, but the operating cost should be lowered by possibly as much as 25%. This reduction would be due, 1, to the smaller amount of man-power indicated; 2, to reduced maintenance; and 3, to the necessity of drying the rock to a moisture content of only 2½-3%, at which the mill appears to operate most efficiently on asbestos rock.

The substitution of tungsten-carbide balls for the comparatively small auxiliary charge of steel balls usually used in the mill appears to increase the unit's capacity up to 25% with an inordinately lower increase in power consumption.

New Methods of Fiberizing

Aside from experimentation with this new mill, much attention is now being paid to new methods of fiberizing the asbestos during and after its extraction from the rock-mass. Most of the large companies have devised fiberizing procedures to fit their sales requirements and some of these have become the basis of American and Canadian patents. The attempt in every case is to flex the longest spicules without injury to the fiber and to produce just that degree of opening to effect maximum fiber value.

In conclusion, then, the Quebec district, which provides between 70 and 80% of the world's asbestos, has, in its search for additional ore reserves and new properties, apparently provided a sufficient tonnage of rock for a normal expansion of its present rate of production for at least another generation.

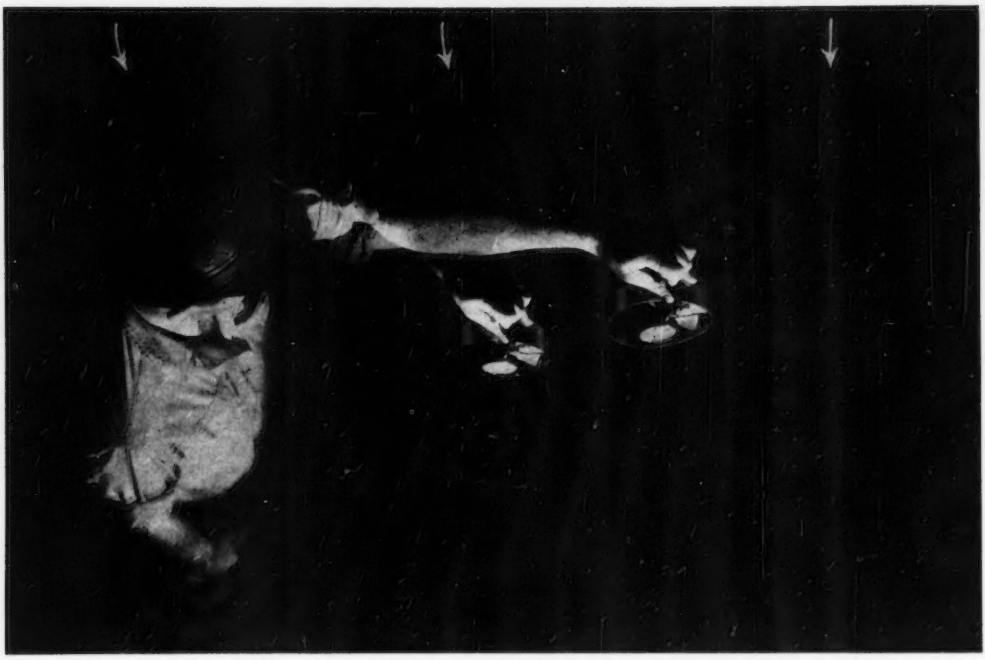
Big Boost in Fibre Output

New mills or plant improvements completed or now under way in Quebec, Ontario, and Vermont should provide an estimated additional 100,000 tons of fiber per year. Potential new producers in the Quebec area may, within the next two or three years, provide an additional 50,000. Hence the production from North America alone might within the reasonably near future reach an annual total exceeding 900,000 tons of chrysotile of all grades. Conceding that it is unlikely that large amounts of Russian fiber will be exported from behind the Iron Curtain and allowing for asbestos developments in other parts of the world, it still seems unlikely that the anticipated production could not be consumed if the American economy continues its expansion and the rest of the world its rehabilitation.

[7]AIME, San Francisco Meeting, 1948, Paper by Gerald Sherman.

[8]AIME Meeting, Columbus, Ohio, Sept., 1949. "A Technical Appreciation of the Aerofall Mill," D. Weston, M.C.I.M.M.

[9]Detailed results of these tests were presented in a paper by D. Weston at the April meeting, 1950, C.I.M.M., at Toronto.



IRREGULAR AIR-FLOW PATTERN caused by presence of operator introduces errors in anemometer reading. Charts on opposite page show how error in velocity readings varies with proximity of operator to anemometer.

How Proximity of Operator Affects Anemometer Readings

STEFAN BOSHKOV[1] and BURTON AMONTREE[2]

IT IS GENERALLY KNOWN that one source of error in taking anemometer readings with the windmill (rotating vane) type is the proximity of the operator to the anemometer. This results from the change in velocity and pressure patterns as air streamlines change their course when moving about a stationary body. However, the magnitude of this error is not well known. Consequently the authors conducted experiments at the Mt. Hope magnetite mine of Warren Foundry and Pipe Corp., Dover, N. J., to determine quantitatively how large an error is produced by proximity of the operator to the anemometer.

[1]Associate In Mining, and [2]Research Associate in Mining, School of Mines, Columbia University.

It was decided that a Pitot tube check on anemometer performance might not reveal the magnitude of this error if the operator, in reading the Pitot tube, would stand as close to it as to the anemometer, since in both cases the flow pattern would be the same. Similarly, a check of anemometer vs. Pitot tube in a small air conduit, with operator outside, would also be worthless.

How Readings Were Checked

Therefore, air velocity was measured with a constant current, varying-resistance hot-wire anemometer which utilizes the principle of proportionality between cooling of an electrically-heated wire and the rate of flow of the air current passing over it. Its guaranteed accuracy, after calibration in a wind tunnel against a Pitot tube standard, is $\pm\frac{1}{2}\%$. Although this anemometer was employed successfully in the present study, its utility for general mine ventilation work has not yet been substantiated.

The instrument consists essentially of two units—the probe containing the heated wire and the case which includes the indicator, batteries, current regulating element, switches, etc. The two elements are connected by a thin cable, whose length may be varied, thus affording a means of taking readings at remote distances from the site. The probe, which is a smooth tube about 6 in. long by ½ in. in diameter, was suspended from the center of the roof, halfway to the floor. Since all measurements were taken in drifts of approximately the same dimensions (9x11 or 10x12), the probe was 4½-5 ft. above the ground. The thin cable connection to the instrument indicator box was carried along the roof and rib for

a distance approximately 30 ft. downstream, where the readings were taken. Sites were selected as follows: sections of drift where measurements were taken were straight and as uniform in cross-section as possible; an attempt was made to set up at points 30 to 40 diameters away from any obstruction, such as bends, doors, chutes, etc., which would have influenced the velocity pattern; complete series of readings were taken during periods when trips were virtually motionless, either loading or unloading, a considerable distance away. Initial readings were taken in an unobstructed section, with operator 30 ft. downstream, and the velocity noted was regarded as the true velocity at this point. Then the anemometer operator was stationed at points 3 ft., 2 ft. and 1 ft. away from the probe and changes in velocity were observed. In all cases, the operator stood with his shoulder leading into the air stream, facing the probe, thus offering the least area of resistance to flow. Since, theoretically, the flow pattern is a function of the average velocity of the air current, tests were run at several velocities.

Curves Evaluate Error

The plot of Percent Error vs. Proximity appears in Fig. 1. Points on these curves represent averages of 5 to 8 readings, with a maximum deviation from normal of less than 2%. The plot shows that for any given air velocity, the error varies linearly with proximity.

Fig. 2 shows the variations in error with air velocity for given proximities of operator to anemometer. It is evident from the plot that a change in the flow pattern occurs somewhere between air velocities of 470 to 500 fpm., and that this change, exhibited as a faster drop in percent error as the velocity increases, is more pronounced the closer the observer is to the anemometer. A brief theoretical explanation of this behavior follows:

The flow pattern is a function of both body boundary form and boundary roughness. The surfaces of separation, delineating turbulence, formation of eddies and negative pressures are functions of these factors. The point on the body boundary at which these surfaces begin moves along the boundary with changes in the velocity of approach. An unstable flow pattern occurs at some value of this velocity at which the point of origin suddenly jumps from the upstream to

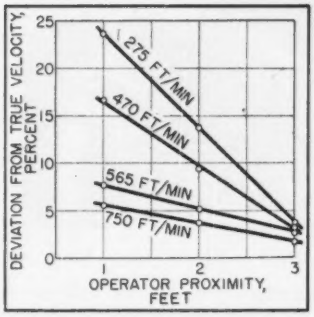


Fig. 1. PERCENT DEVIATION from true velocity as compared with operator proximity.

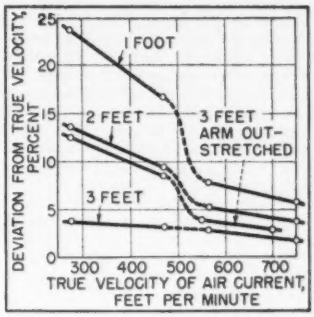


Fig. 2. PERCENT DEVIATION from true velocity as compared with true velocity of air current.

the downstream side of the body. This is accompanied by a radical change in the flow pattern. Since at higher velocities the fluid tends to adhere closer to the body boundaries, the effect of velocity disturbances along lines perpendicular to the direction of flow is greatly reduced.

The data show that the errors tend to increase the readings in all cases.

Single spot-check readings, as commonly employed in underground ventilation work, may be directly corrected for such errors. A continuous survey, where the anemometer has traversed the section, may also be corrected by use of the charts. It is true that in such cases the error may possibly be smaller at some positions during the survey, such as when the instrument is held above the observer's shoulders, but then it will probably be higher when the anemometer sweeps low, since in the crouched position the observer is bound to introduce a greater area of obstruction.

It is also noted, as part of the experiment, that the effect of an outstretched arm increased the error. At a 2 ft. distance, this showed erratic results, because the obstruction to flow was too close to the exposed probe, and small variations in position of the fingers had a great effect on the readings. The probe, being of a different physical construction than the vane anemometer, cannot be expected to be affected similarly to the latter in cases where the obstructing body is in contact with the instrument. At a proximity of 3 ft. the results yielded the curve shown in Fig. 2, indicating an appreciable rise in all points. It may, therefore, be safely assumed that in actual practice, the error may be even higher than indicated.

What the Tests Reveal

The following conclusions may be drawn from the experimental data for the range of air velocities from 275 fpm. to 750 fpm.

In the case of anemometer air velocity measurements taken with the operator standing in the plane of the instrument—

1. The error increases with decrease in true velocity, for any given proximity of operator.

2. The error varies linearly with proximity and inversely with distance between operator and anemometer, for any given true velocity.

3. The velocity measurements may be expected to be inconsistent somewhere in the range of true velocities between 450 and 550 ft. per minute, the erratic nature being more pronounced the closer the operator is to the anemometer.

4. The charts may be used to correct anemometer readings and to suggest procedure to be used under different flow conditions for insuring readings within a certain range of error.

5. The procedure of mounting the anemometer on a 1½ to 2-ft. thin rod, perpendicular to the axis of the instrument, may materially reduce the error by increasing the distance between operator and instrument. Such procedure should be followed wherever possible.

Acknowledgment: The authors are indebted to Mr. F. G. Woodruff, Mine Superintendent at Mt. Hope, for permission to carry out the field work at the mine, and to Mr. Randolph Brogan, Safety Engineer, who so generously assisted in selecting the sites and in the experimental work.

KEEPING TAB ON PRACTICE

Diesel Power for Haulage. Just how rapidly the idea is growing in this country and Canada of using diesel haulage underground remains to be seen. Time is required to overcome prejudice against discharging into mine workings the exhaust gases of an internal combustion engine. Though the Bureau of Mines stipulates, as it has, that ventilation must first be adequate before an attempt is made to use diesel haulage, the existence of good ventilation alone is not enough to bring about a favorable decision. Other obstacles there may be, such as existing investment in a different kind of equipment. In the main, the operator wants to be shown.

In this country, it is still true that there are few installations of diesel locomotives underground in comparison with those in Europe or South Africa, and foreign practice is not copied quickly. Universal Exploration Co.'s zinc mine, at Jefferson City, Tenn., provides the most recent instance of such an installation. The locomotive is a 30-ton unit. It will make a long haul to the shaft, and battery locomotives will be used for gathering.

Diesel-powered trucks are coming into underground service in increasing numbers, and with them miscellaneous equipment, such as loaders and tractors, that are also diesel-powered. It was in January, 1946, that Eagle-Picher introduced diesel trucks in its Tri-State operations. Today, according to S. S. Clarke, general superintendent, it has 55 diesel-operated units in its workings, where mining is done in large open stopes at shallow depth and ventilation is excellent. Comprising this number, there are 34 trucks, 18 loaders, one drill jumbo, one road grader and a bulldozer. In addition, two trucks and a portable diesel-driven compressor are in transit. Eagle-Picher provides the outstanding example of this practice. Others might be cited.

Last year Joy Manufacturing Co. completed its pilot diesel-electric shuttle car, as told in *E&MJ's* Survey, Feb., 1950, page 114. This car has now been operated for nine months or more, with good results it is said. Striving with a haulage problem in its gypsum mine at Acme, Texas, the Certain-teed Products Corporation also has provided a shuttle car with diesel-electric drive, converting it from storage-battery power. In this way it solved the problem which had been caused by the increase in length of haul as mining advanced and by excessive grades due to undulation of the gypsum bed. (See Bureau of Mines R. I. 4643, D. H. Pratt, Jan., 1950).

In weighing the advantages and disadvantages of using diesel power underground, the operator will set the saving to be made in fuel cost (as compared with electric power) against the problem of disposing of noxious gases and heat produced. The diesel motor is not tied to the power line. In this respect it is on a par with the battery locomotive. Trackage remains the same and bonding becomes unnecessary. Applied to trackless equipment underground, diesel operation achieves maximum flexibility. Maintenance is said to cost somewhat more than for corresponding electrical equipment.

Recently the American and Canadian field was scanned by the representative of a British manufacturer of diesel mine locomotives. This suggests that the experienced eye sees possibilities here. The visit followed the introduction, a year or more earlier, in the Alberta coal field, of a locomotive made by another British firm.

Additional Capacity for Single-Use Bit. Nearing completion in Calumet & Hecla's shops is a second production line for making Liddicoat detachable bits. Within the next few months, it is expected, the bit plant will be running at its rated capacity of 6,000,000 bits per year. C.& H. is licensed exclusively by Thompson Products Ltd., St. Catharines, Ont., to make and sell this single-pass bit in the 37 states east of Montana, Wyoming, Colorado and New Mexico. It installed only a single production line in 1946, when it adopted the bit for general use at its Calumet Division.

Tipped Steel vs. Tipped Bits. "Tipped forged steels have their limitations too," writes some one in Canada who sees a great future for detachable carbide bits. "The main difficulties with them are (1) the problem of handling long lengths up and down the shafts; (2) deciding whether to resharpen them on the site underground or in a central resharpening shop; and (3) handling them up and down manways and raises.

"The development of the use of light machines with detachable hard-tipped bits is definitely here to stay," this correspondent adds. "Here in Canada we are witnessing the elimination of the heavy, oversized drifter, sinker and stoper."

Carbide Bits Improved. Inco's February "Nickel Topics" says that Kennametal, Inc., now employs in the bodies of its bits a nickel-chromium-molybdenum steel which provides a good combination of toughness, strength and resistance to the elevated temperatures which develop from constant pounding. With the steels previously used, upsetting and deformation in the threads and resultant skirt breakage tended to occur. The nickel-alloy steel mentioned, which has solved this problem, is heat-treated to a hardness of 44/49 Rockwell C. The Kennametal inserts are brazed on after hardening.

The cemented carbide called Kennametal is essentially a tungsten-titanium carbide produced by synthesis of the basic materials in a nickel bath. The double carbide has a different crystalline form from that of tungsten carbide, is harder, and provides resistance to deformation at high pressures and temperatures.

Better Air for the Miner. At Roan Antelope, percussion rock drills are front-head vented. Fumes from secondary blasting are drawn into return airways. Dust-laden air at loading and dumping points is cleansed by passing it through flannel-bag or electrostatic filters.

Speeds Open-Pit Track Shifting. In preparing new roadbeds on which to shift tracks, a Southwestern copper company has found a tractor-drawn wheel scraper useful in speeding up the work. It eliminates half the man-power, prepares the grade in such a manner that minimum ballasting is necessary.

Fast Delays at Canadian Malartic. Further comment on short-period delays comes from this Quebec gold company, which uses them in a range from the first to the eighth delay and finds them definitely better than the same manufacturer's regular delays previously used. The advantage is apparent chiefly in intricate blasts, as in pillar-recovery work where slower delays would run the risk of cut-off primers. The fast delays are also thought to produce finer fragmentation, although the opportunity to assess such results is limited in the large open stopes. Another advantage is that these delays leave little broken ore on the rock-drill benches, so that much less mucking is needed to clean off the succeeding bench.

MARKETS—Trends and Prices (*Continued from page* 69)

Summary of Copper Statistics

Following is a summary of the copper statistics reported by members of the Copper Institute, figures in tons:

UNITED STATES

Production:	Oct.	Nov.	Dec.	Jan.	Feb.	March
Crude, primary	62,775	67,479	71,864	73,625	69,994	78,561
Crude, secondary	6,277	13,119	8,526	12,001	10,762	11,391
Totals	69,052	80,598	80,390	85,626	80,756	89,952
Refined	86,882	92,602	94,947	95,229	94,036	113,440
Deliveries, refined	108,192	117,133	107,662	111,668	112,773	123,030
Stocks at end, refined..	164,464	139,199	116,027	101,070	77,472	60,276

OUTSIDE UNITED STATES

Production:	Oct.	Nov.	Dec.	Jan.	Feb.	March
Crude, primary	104,101	104,822	97,156	106,162	110,089	107,668
Crude, secondary	1,696	1,036	975	1,669	549	1,227
Totals	105,797	105,858	98,131	107,831	110,638	108,895
Refined	85,150	84,571	83,261	87,923	83,501	84,604
Deliveries, refined	75,391	78,898	77,604	81,574	69,193	72,626
Stock at end, refined...	151,443	148,161	147,972	142,971	144,893	148,455

Official London Prices

The British Ministry of Supply continues to fix delivered prices of copper, lead and zinc for the United Kingdom. Quotations in effect as April ended were as follows:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	162	0	0
Fire refined, high conductivity	162	0	0
Fire refined, high grade	161	10	0
Fire refined, min. 99.7 percent	161	0	0
Fire refined, min. 99.2 percent	160	10	0
LEAD:			
Soft, foreign duty paid	86	0	0
Soft, Empire	86	0	0
English, refined	87	10	0
ZINC:			
Foreign (G.o.b.) duty paid	95	10	0
Domestic (G.o.b.) duty paid	95	10	0
Prime Western and debased	95	10	0
Refined and electrolytic	96	5	0
Minimum 99.99 percent	97	15	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

(April 29, 1950)

Aluminum, ingot, 99 plus percent, lb. (base price)	17c.
Antimony, spot, lb., 5 tons and up but less than carload in cases	27.78@
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, delivered, lb.	$2.00
Calcium, 1 lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$1.80
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	40c.
Magnesium, 99.8 per cent, carloads, lb., producer's plant	20¼c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$66.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$71.00
Selenium, 99.5 percent, lb.	$2.00
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty

METALLIC ORES

Beryllium Ore, imported, 10 to 12% BeO, per unit	$26.00@$28.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio	$32.50
48% Cr_2O_3, 3 to 1 ratio	$35.00@$36.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$8.10
Mesabi bessemer	$7.85
Old Range non-bessemer	$7.95
Mesabi, non-bessemer	$7.70
Lead (Galena), 80 percent, Joplin, Mo., ton	$133.27
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, 74 @ 76c., c.i.f. U. S. ports, duty extra. Long-term contract prices nominal.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	54c.
Tantalite, 60% concentrate, per lb.	$2.00@$2.75
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, duty paid	$18.75@$19.25
Domestic, scheelite, 60 percent and upward	$28.50
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo. per ton	$65.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5¼c.
Cobalt Oxide, 72%, metallurgical grade, per lb. of Co	$1.95
Copper Sulphate, 100 lb.	$7.35

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of contained Be	$24.50
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	20.50c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$172.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo, contained	$1.13
Ferrosilicon, 50 percent, per lb. of contained Si	11.3c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.25
Ferrovanadium, per lb. of V delivered	$2.90
Silicomanganese, 1½ percent C, per lb. contracts	8.85c.
Spiegeleisen, per long ton, 19@21%	$68.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960@$1,050
Crude No. 2	$492@$550
Spinning fibers	$232@$475
Shingle fibers	$95.50@$141
Paper stock	$78.50@$88
Waste	$58
Shorts	$27@$52
Vermont, f.o.b. Hyde Park:	
Shingle stock	$97.00@$107.00
Paper stock	$68.50@$85.00
Waste	$51.00
Refuse or shorts	$25.50@$46.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.00@$9.60
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	$4.00@$5.00
Domestic, chemical, 55 to 58 percent	(a)$8.50@$9.50
Domestic, abrasive, 80 to 84 percent	$18.00@$18.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, airfloated bulk	$8.50@$9.50
North Carolina ceramic grade	$18.00@$20.00
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh	$18.50
Glass spar, white, 20 mesh	$11.75@$12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$37.00
Acid 97% concentrate, bulk, ton	$42.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$30.50
Mica—Domestic f.o.b. mines, Punch, 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 70 to 75c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.40@$1.50; 3 x 3 inch, $1.70@$1.80; 3 x 4 inch, $2.10; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $120 @ $130 per ton. Bulk sales, dry ground, $22.50@$60.00 per ton. Scrap, $30 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a)12@14c.
Sulphur, Texas, mines, long ton	$18.09
Talc, f.o.b. works, ton:	
New York, purified	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

(a) Nominal

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$46.00
Steel, f.o.b., Pittsburgh billets, net ton	$53.00
Structural shapes, 100 lb.	$2.40

WASHINGTON REFLECTIONS

Seabrook Hull, McGraw-Hill Washington News Bureau

New Round of Tariff Reductions Threatened

YOU WILL BE HEARING A LOT more about tariffs and world trade for the rest of the year. The end results will probably spell more tariff reductions in the mineral field.

Greater imports of foreign goods is a primary U. S. foreign policy objective. With exports still outstripping imports two to one, administration planners see no other way to close the "dollar gap." The concept that foreign nations might balance their trade by reducing their imports from the U. S. seems to be unpalatable.

What you'll be hearing most about are the tariff-cutting negotiations to take place next September at Torquay, England. The list of goods scheduled for possible import duty reductions includes many metals and minerals. Not all of these will suffer tariff cuts, however. In part, at least, publication of this list is meant to test public reaction here in the U. S. The State Department is trying to get an idea of how far they can go without infuriating too many people.

Hearings before the Tariff Commission's Committee for Reciprocity Information will soon be held. Here, those who object to various products being included in the negotiations will have their day in a court whose objectivity has always been questionable. Many view these hearings as merely a facade to give a look of impartiality to the State Department's tariff-reduction program. Some items will be dropped as a result of testimony submitted. Nevertheless, the final list will still be long.

Here are some of the metals and minerals included in the list of "negotiable" commodities: cobalt oxides and salts; lead, chrome and barium pigments; zinc chloride, sulphate and sulphide; dead-burned and grain magnesite; gypsum; clays or earths, including bentonite, china clay and kaolin; feldspar; mica; talc and soapstone; bismuth; nickel and alloys; lead and lead ores; zinc ores and slab zinc, ferro-alloys, manganese (metal), chrome metal and alloys; barium, bismuth, boron, calcium, molybdenum, strontium, titanium, uranium, thorium, vanadium, zirconium, pig iron, iron and steel products and steel ingots. Chromite, brass and copper sulphate may be bound on the free list.

At Torquay the U. S. will "trade" U. S. import duty cuts for similar cuts by other nations which import U. S. products. However, such trades have generally proved to be one-sided—the U. S. opening up the world's largest market in return for being allowed easier going in other markets, which even in the aggregate, don't compare in size. Also the State Department has winked at steps by other nations to defeat the purposes of reciprocal trade by such steps as exchange controls.

On the other hand, it is probable that the State Department may denounce the Mexican trade agreement, thus restoring older tariff rates on lead, lead ore, and lead products, fluorspar, and molybdenum ore and concentrates. However, considering that most of these are on the new negotiable list, the period of higher duties may be short or even non-existent.

Despite the great odds against tariff proponents in these hearings, it is advisable that they should not neglect the opportunity to present briefs or be heard.

Odds Favor Copper Tariff Opponents

CONDITIONS HAVE changed sufficiently in a month that the copper tariff exemption now stands a good chance of being extended another year or two. Treasury, State, Commerce and Interior Departments, as well as the Budget Bureau, have all come out in favor of the extension. It now looks as if the House Ways and Means Committee will report the bill out favorably and that Congress will pass it. If they do, the President will sign it.

The increase in the price of copper in late April, coupled with the limited stocks in producer's hands, are a severe handicap to the pro-tariff side of the argument.

There is some possibility that there may be a successful effort to cut the extension down to one year instead of the two now written into the bill.

Attack on Silver Not a "Pushover"

THERE MAY BE A FUROR over the bills up before Congress to repeal the Silver Purchase Act, but the odds are against action, provided that the domestic producers of silver do not neglect to make themselves heard effectively.

The Senate Banking and Currency Committee was due to hold hearings on Senator Green's (D., R. I.) S. 2829 on May 2. It looks as though the bill will be reported out of committee, but that it will probably be blocked on the Senate floor. Silver-bloc senators will do everything they can to prevent its passage, including a filibuster if necessary, but there is no basis for complacency on the part of silver producers.

In the House, Rep. Celler (D. N. Y.) has introduced H. R. 8034, which would also repeal the Silver Purchase Act. It has been referred to the House Ways and Means Committee, which isn't even sure it will get scheduled for hearings. Even if a hearing is scheduled in the rush of last minute business, probably the committee won't act. Because of the jeopardy of small mines in the West, the loss of the silver purchase program would be a very serious blow.

Depletion Apparently in the Clear

CONGRESSMEN STILL have no intention of tampering with depletion laws this year. Bulk of House Ways and Means Committee effort is aimed at cutting as many excises as possible without cutting enough to provoke a Presidential veto.

Some "loopholes" will be closed, such as those governing collapsible corporations, charitable trusts, and the like. There may be a 10% withholding tax on corporate dividends.

There's a good possibility the House Committee may include a 2% rise in corporate income taxes, thus hiking the total to 40%, but if they do, it will be to have a bargaining point with the Senate Finance Committee,

which doesn't want to go as far in cutting excises. The Senate would strenuously oppose higher corporate taxes.

Stockpiling Policies Are Scheduled for Probe

SOME MINING CONGRESSMEN, still stung by S. 2105's last minute defeat, would like to force the Munitions Board to buy more strategic materials in the U. S. However, their chances of success are slim, unless the whole concept of the stockpiling law is changed.

Munitions Board officials, however, will be on the carpet when they appear before Rep. C. T. Durham's (D., N. C.) House Armed Services subcommittee on stockpiling. Rep. Durham, along with the ranking subcommittee Republican, Rep. Dewey Short, of Missouri, wants to see more stockpile material bought from U. S. producers.

The hearing is going to sound good to domestic miners and result in a lot of noise, but men responsible for this phase of national defense think they've got the right answers. Here they are:

Of the 71 items being stockpiled, 52 are minerals. Of these, only eight are produced to any degree in the U. S.; only 27 are produced at all in this country. All the rest have to be bought 100% from foreign sources.

Sole reason for the stockpile is national defense—to have enough materials on hand to carry us through another emergency.

Inherent in the stockpiling act is the board's duty to get as much as it can for each taxpayer's dollar it spends. That was and still is the intent of Congress and the President. The Board interprets the Buy American provisions of the stockpiling law to give domestic products preference, but not at premium prices.

Mining interests which advocate "Buy American" should bear in mind that stockpile purchases are important sustaining factors to present prices of most minerals; thus they will injure themselves if an attack on the Board reduces the purchase program.

LABOR THIS MONTH

Joseph M. Gambatese
McGraw-Hill Washington News Bureau

● If you suspect non-Communist affidavits filed by officers of a local union are false, it will do you no good to protest to NLRB. The Labor Board accepts affidavits at face value, leaves any policing to the Justice Department. It rejected recently a company protest against certification of a left-wing local.

● Philip Murray's United Steelworkers have decided to move in on the potash mines in Carlsbad, N. M., where the CIO-expelled Mine, Mill union recently lost its strike. In Canada, the steel union claims to have pushed Mine, Mill out of the metal mines in northwestern Quebec. It is ready, also, to ask for certification at Hollinger, Canada's largest gold mine at Timmins, Ont.

According to the CIO, Mine, Mill has lost 37 of its 42 contracts in eastern Canada since expulsion from the Canadian Congress of Labor.

● During a union bargaining election campaign, you can call union leaders Communists and you can campaign against a union as being undesirable in your mine. But don't promise the workers any special benefits if the union is licked, or threaten reprisal if the union wins. That violates Taft-Hartley's "free speech" protection, NLRB says.

● Mining electricians comprise a skilled craft and may choose to separate themselves from the overall group of mining employees. This was decided by NLRB in directing that an election be held among the electricians employed by 22 lead, zinc and silver mining companies in the Coeur d'Alene mining district of Idaho. The electricians will choose between the AFL electrical workers and Mine, Mill, which has represented all the men.

In this same decision, NLRB ruled that "concurrent" negotiations which the companies have conducted with Mine, Mill and several of its locals since 1942 amounts to "joint" negotiations. Therefore, the Board held, the electricians at all the mines may be combined into a single bargaining group even though there never has been any formal grouping of the companies for bargaining purposes.

The mining companies contended: first, that the electricians were not a skilled craft and, second, that any election should be on an individual mine basis, and not in a multiple unit. NLRB disagreed.

● UAW-CIO's "Die Casting Newsletter" accuses Mine, Mill of selling out Kennecott workers at Garfield, Utah, with a 5-c. hourly wage increase settlement, while the Progressive Metal Council, CIO, was getting ready to strike nearby American Smelting & Refining Co. for more. AS&R settled for the same 5c. and some improvement in vacation and health benefits.

● The CIO Steelworkers Union brought a delegation to Washington late in April from its new local (No. 4264) made up of employees of Silver King Coalition out in Park City, Utah. Accompanied by Varro Jones, USW-CIO staff man from District 38, the group included: William O'Keefe, vice-president of Utah's CIO council; Matt Leahy, president of the local, and Stanley Fisher, vice-president. The delegation urged members of Congress to reconsider S. 2105, the O'Mahoney mine subsidy bill, and to take other steps to relieve unemployment in metal mining. This local, formerly with Mine, Mill, shifted to the Steelworkers, but is now out of work. The Silver King is shut down tight.

Brief, but Important

MINE LEASERS—OTHER SUBCONTRACTORS won't be included in the Senate version of the Social Security bill. At least that's what committee members are saying now. Actually, the bill isn't due to be reported out of committee much before mid-May. If the Senate does exempt mine leasers, as expected, there's a good chance that the Senate-House conference version which goes to the President will read the same way.

INCENTIVE PAYMENTS—There's growing talk of trying to revive S. 2105 this year. Some effort may be made in that direction. Rep. Cox of the House Rules Committee, who fought S. 2105, has indicated he would go along with an incentive payment bill written to Administration specifications, including only non-ferrous metal ores. It's getting late though, and even if a bill were introduced now, its chances of getting through before Congress quits are slim.

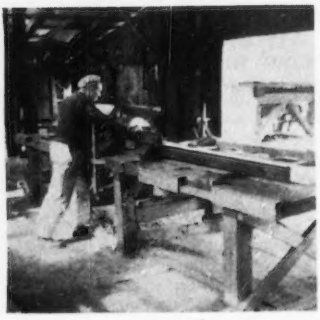
MINE TAX INCENTIVES—The one chance remaining is that the Senate Finance Committee, when it gets the tax bill, could insert a clause giving some kind of tax relief to new mining ventures. While many who voted against S. 2105 might be inclined to go along with something of this nature, no one is optimistic that it will be done. Excise tax cuts will cut revenue far more than any planned tax increases can make up, thus the Senate committee is worried about widening the deficit.

FOREIGN AID—It looks like ECA will get most of what it's asking from Congress. Efforts to reduce the $3.1 billion requested, or to saddle the foreign aid program with "surplus-dumping" amendments have largely failed.

OPERATING IDEAS

TOP CARRIAGE is used to push four to six ladder sides across cutter head.

NOTE CUTTER head which projects through top center of the table.



OPERATOR GRASPS carriage to push ladder sides over cutter head.

Ladder-Making Machine Cuts Costs by 50 Percent

H. M. COURTNEY[1]

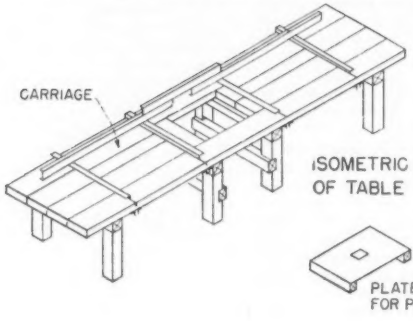
The cost of making wooden ladders at the Idaho Maryland Mines Corp., Grass Valley, Calif., has been cut by more than 50% with the ladder dapping machine illustrated here. Ladders are made from 2x4-in. side pieces and 1x4-in. rungs 16 in. long. Width of the ladder inside the side pieces is 12 in.

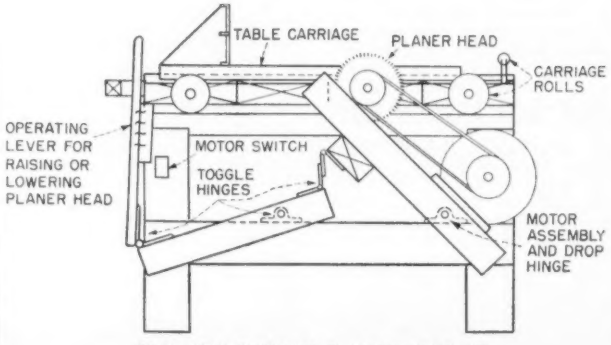
Formerly rungs were nailed on the sides and 1x2-in. spacers were nailed between the rungs on the ladder sides. Now, however, the ladders are dapped with the special machine shown here. In contrast to cutting one dap at a time by conventional hand-framing methods, this machine cuts daps into four to six ladder sides at one time.

One movement of the carriage across the table causes the cutter head to cut proper size daps in the ladder sides. The cutter head is supported and driven from below the table. It is simply a dado head or planer head 8 in. in diameter and 4 in. wide with a saw on each end slightly larger in diameter than the head so it will cut ahead of the planer to insure smooth sides in the cut. The cutter is keyed to a shaft rotating in high-speed, self-aligning bearings. It is driven by a small electric motor at 3,600 rpm. through a double V-belt drive. Motor and cutter head bearings are as-

[1]Chief engineer, Idaho Maryland Mines Corp., Grass Valley, Calif.

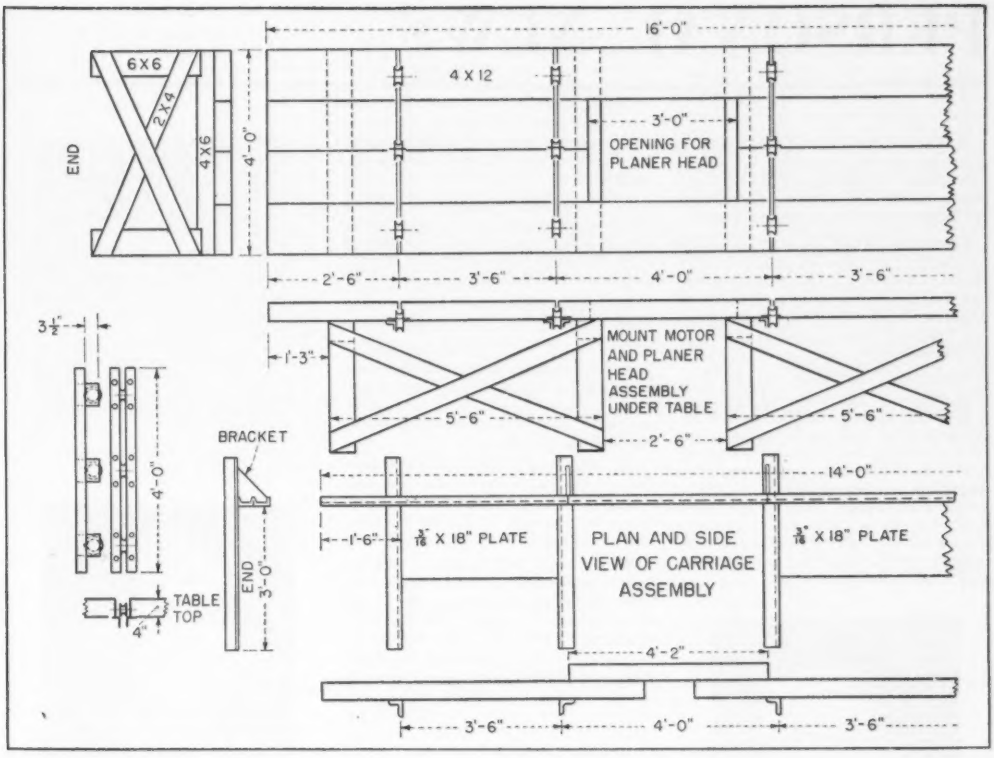
MACHINE TABLE FOR DAPPING LADDERS





END VIEW SHOWING PLANER HEAD UP

NOTE: TRAVEL STOPS FOR PLANER HEAD UP OR DOWN POSITIONS NOT SHOWN



sembled on a 4-in. angle-iron frame with "slide motor" adjustment for tightening the belt.

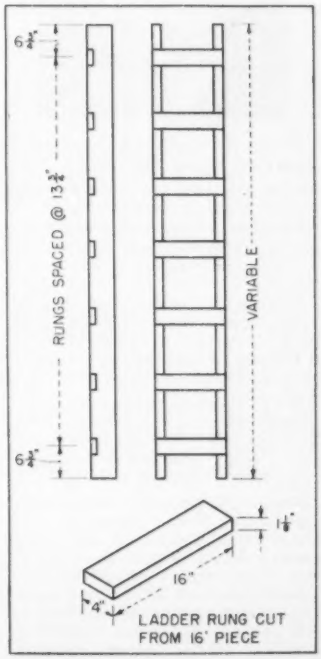
The table is constructed as shown. Pull-out cross pieces on both ends of the table permit 16-ft. ladder sides to be dapped. These units will support the overhang of the long stock while the first and last daps are being cut.

The traveling carriage is made of channel iron and angle iron. It travels on sheave-type rollers mounted on the table top. Slots cut ½ in. deep in the table top allow the angle-iron edge to travel with clearance. Rollers above the angle iron are attached to the table top near the edge to keep the carriage from tipping as the back end of the angle drops off the back sheave roller. One-half-in. pipe rollers are placed in cut-out sections of the top of the angle-iron runners to roll the ladder sides lengthwise on the carriage.

The cutter head assembly mounted under the table is hinged on a 1½-in. pipe through the channel under the motor end and pivots on bearings attached to crosspieces between the center table legs. A lever hinge for raising and lowering the cutter head is double hinged and operates as shown in the drawing.

Here's how the machine operates. Four to six ladder sides are placed on the carriage. Daps are cut into the side pieces as the carriage is pushed across the cutter head. Then the ladders are pulled lengthwise along the carriage for the next dap. Dap spacing is controlled by putting the ends of the ladder sides on marks on the carriage before each successive dap is cut. As the cutter head is hinged, it can be lowered before the carriage is returned for succeeding cuts of the daps. Stops limit the vertical travel of the cutter head so that correct depth is always maintained. It was also found helpful to tack a light wood frame with handle to the ladder sides to facilitate handling four to six sides as a unit and prevent slipping.

This machine can also be used to dap the ends of round or square timbers for framing. Roy Dodge, carpenter, and Joe Glennon, machinist, are responsible for the success and construction of this dapping machine.



PERSONAL NEWS

G. Chesterfield-Evans, metallurgist, is acting general manager for Takuapa Valley Tin Dredging N. L., West Siam, during the absence of **Edward A. Lamb,** who is on extended leave.

Lester F. Bishop, formerly research production foreman of the Anaconda Copper Mining Co., at Butte, Mont., has recently been appointed research engineer in charge of the Butte Mining Research Department of the Anaconda company.

Tom Lyon, assistant to the general manager, International Smelting & Refining Co., retired March 11 after 28 years of service. After graduation from the Montana School of Mines, at Butte, he worked as a geologist for Anaconda, parent company of IS&R, in the Butte area. Mr. Lyon joined International in 1922 and was named chief geologist in 1927, serving in that capacity until 1924 when he was made assistant to the general manager.

SIDNEY J. McCARROLL, who has been associated with mining enterprises in South America and Mexico for several years, has gone to Manila as chief engineer for the Philippine Development Corp. His temporary address is Manila, P. I.

Edward V. Hardy, until recently metallurgist in copper smelting at the Garfield smelter, American Smelting & Refining Co., has been named assistant superintendent.

W. L. Hanson, assistant electrical superintendent of Calumet & Hecla, has been made electrical superintendent. He is a graduate of the Michigan College of Mining & Technology.

Ben R. Coil, formerly general superintendent of Miami Copper Co. and Castle Dome Copper Co., has been made assistant general manager of both companies. **J. W. Still,** mine superintendent of the Miami Copper Co., has been made general superintendent of both companies, succeeding him. **W. F. Distler,** formerly assistant mine superintendent of Miami Copper Co. has been appointed mine superintendent.

L. A. Crozier, formerly of Loloma (Fiji) Gold Mines, N. L., Vatukoula, Fiji, has been made general manager of the Raub (Australian) Gold Mining Co., Ltd., at Raub, Malaya.

Elisindos Quiros de Leon is now chief of the Mining Department, Panama City, Canal Zone.

A. G. Roach, formerly ore dressing engineer for the Mining Corporation of Canada, Ltd., has been appointed mill superintendent at Malartic Goldfields, Ltd., Quebec.

Dr. Ben H. Parker, whose resignation as president of the Colorado School of Mines became effective April 1, has been named to fill a vacancy on the school's board of trustees.

J. L. Cooper, of Spokane, Wash., and **John Merkel,** of Bremerton, have been appointed members of the board of directors of Columbia Gypsum Products, Inc., to fill vacancies. **Loren Brown,** president, announced recently that **John C. Tenold,** of Bremerton, a chemical and metallurgical engineer, would manage the engineering operations of the company.

Anthony Strojan, Jr., for many years manager of the Montana mining operations of Winston Bros. Co., of Minneapolis, recently resigned and is making his headquarters at 624 North Benton Ave., Helena, Mont.

Fred W. Black, past vice president of the Mining Association of Montana, and past president of the Madison County Mining Association, is now with the Whitehall State Bank at Whitehall, Jefferson County, Mont.

Ray W. Jenkins, formerly Special Representative, Joy Manufacturing Co., is now assistant manager of Coplay Cement Manufacturing Co., Coplay, Pa.

I. H. Rubow, superintendent of Oliver Iron Mining Co.'s Walker mine, near the west end of the Mesabi range, has been transferred to the Mountain Iron open-pit mine in the Virginia-Eveleth district as superintendent. **J. H. Harrison,** who has been superintendent at the latter mine, succeeds Mr. Rubow at the Walker mine.

Edward G. Gersich, Hibbing, has been appointed district safety inspector for Oliver Mining Co. in the Canisteo district on the Mesabi range to succeed **R. S. Barrett** who has resigned and moved to Texas. **Gerald J. Kaiser** replaces Mr. Gersich as safety inspector in the Hibbing-Chisholm district.

Warren Fisher, Ishpeming, geologist with Inland Steel Co., has returned from Steep Rock Lake, Ontario, where Inland has six diamond drills working on an area recently taken under option from Steep Rock Lake Iron Mines, Ltd.

Harold J. Richards, of Caspian, Mich., general superintendent on the Menominee iron range for Pickands, Mather & Co., has been spending a month in Cuba.

W. A. Coster, mining engineer, left recently for Dutch Guiana to serve as assistant superintendent for one of the bauxite fields of the Alcoa Mining Co. His new address is % Surinaamsche Bauxite Maatschappy, Paramaribo, Dutch Guiana.

J. K. RICHARDSON, manager of the Utah Mining Association for the past four years, has been appointed industrial engineer for the western operating divisions of Kennecott Copper Corp. Announcement of the appointment, which became effective May 1, was made by Louis Buchman, general manager. Mr. Richardson's headquarters will be in the offices of Kennecott's Utah Copper Division in Salt Lake City. A native of Missouri, he received a B.S. degree in mining engineering in 1932. Following graduation, he became mining and chemical engineer for the U. S. Potash Co., Carlsbad, N. M., and in 1936 was made director of safety and industrial hygiene for Climax Molybdenum Co. He resigned in 1942 to become secretary of the Tri-State Zinc & Lead Ore Producers Association. After serving in the U. S. Army during World War II, he joined the Utah Mining Association as assistant manager and in 1946 was appointed manager.

Edward H. Snyder, president of Combined Metals Reduction Co., was re-elected president of the American Zinc Institute for a second term. **Clarence Glass, George Mixter** and **Raymond Orr** were re-elected vice presidents; **Erle V. Daveler** was re-elected treasurer, and **Ernest V. Gent**

continues as executive vice president and secretary. **K. C. Brownell, F. J. Childress, E. R. Dondorf, R. E. Dwyer, Benno Elkan, Andrew Fletcher, Elmer Isern, B. N. Zimmer** and Mr. Snyder were elected directors.

H. J. RAHILLY, Butte, Mont., manager of mines for the Anaconda Copper Mining Co., has been appointed chairman of the Montana program committee for the American Mining Congress metal mining convention and exposition to be held in Salt Lake City, Aug. 28-31.

The National Safety Council has announced the location of its new headquarters at 425 North Michigan Ave., Chicago, Ill. Prior to May 1 it was located at 20 N. Wacker Drive.

Norman C. Urquhart, of Toronto, Ont., has been made a director of Hudson Bay Mining & Smelting Co., Ltd., to succeed the late **J. H. C. Waite.**

JOHN K. GUSTAFSON, formerly manager of the U. S. Atomic Energy Commission's Raw Materials Operations Office, has been appointed to the AEC Advisory Committee on Raw Materials. He served in that position from Dec. 1, 1947, to Jan. 1, 1950, when he resigned to become consulting geologist for the M. A. Hanna Co., Cleveland, Ohio.

Dr. Robert R. Shrock has been appointed head of the department of geology, Massachusetts Institute of Technology. He joined the faculty in 1937 after teaching at the University of Wisconsin for eight years. During the past 20 years he has been consultant for numerous mining and petroleum companies and for several museums and state geological surveys. **Dr. Patrick M. Hurley,** assistant professor at M.I.T., has been appointed executive officer of the geology department. A native of Hong Kong, he was educated at the University of British Columbia, and received his Ph. D. at M.I.T. in 1940. During World War II he was a research associate with the National Defense Research Committee on anti-submarine warfare.

OBITUARIES

J. R. Blackburn, of Hibbing, Minn., widely known in the Lake Superior Iron Country and among contractors and mining company personnel elsewhere throughout the country, died Mar. 25. For 15 years he represented Euclid Road Machinery Co. in Minnesota, becoming manager of the Hibbing branch in 1940.

John A. O'Neill, 56, research engineer of the Anaconda Copper Mining Co. in charge of the Butte research office, died suddenly Jan. 17. He joined the staff of Anaconda in 1918.

Alonzo H. Tuttle, 69, retired district engineer of the U. S. Geological Survey, died Mar. 5 in Helena, Mont. Prior to his retirement Dec. 31, 1949, he had served 49 years with the USGS.

Julian Parker Cole, engineer of Stone & Webster Engineering Corp., died in an airliner crash in Turkey Mar. 25. He had been working for the Turkish Eti Bank, which has charge of all mining operations in Turkey.

Richard Alexander Wagstaff, metallurgical engineer, died Mar. 8 at his home in Salt Lake City. He entered the industry in 1911 with Utah Copper Co. and later became associated with American Smelting & Refining Co. In 1936 Mr. Wagstaff was named vice president and assistant to the general manager of all western operations of that company, which post he held until 1948. He also served as consultant to Nevada Consolidated Copper Co. and Phelps Dodge Co.

Richard James Evans, Jr., general superintendent of milling operations in Utah and Nevada for the Combined Metals Reduction Co., died at Tooele, Utah, Mar. 25.

Carl G. Naylor, founder and president of the Naylor Pipe Co., Chicago, Ill., died suddenly Feb. 13. He was 70.

Herbert Allen Wheeler, mining engineer and nationally-known expert on ceramics and refractories, died in March. He was 91. Following his graduation from Columbia University in 1880, he assisted in a government geological survey in Utah and in construction of the Denver & Rio Grande Railroad. He served as professor of mining and geology at Washington University for 12 years.

Robert L. Pellet, 77, died recently in Denver, Colo., following a long illness. He made his home in Rico, Colorado, where for 31 years he served as president and general manager of the Falcon Lead Mining Co. and the Pelleyre Mining & Milling Co.

Edwin S. Giles, mining engineer, prominent in Cripple Creek 50 years ago, died recently at Goldfield, Nev. At the time of his death he was writing a book on geology and gem formations. He was an amateur gem-cutter and polisher and possessed many beautiful and valuable stones.

James G. Parmalee, Oakland, Calif., mining engineer, died Mar. 30. For many years Mr. Parmalee was secretary to the late **F. W. Bradley,** president of Alaska-Juneau Gold Mining Co.

Addison N. Clark, former manager of several Nevada mining properties, died recently at Fort Miley Veterans Hospital. He was 68.

Wallace B. Alexander, 89, retired mining engineer, died recently in his Sacramento, Calif., home.

Palmer Gray, superintendent for Pickands, Mather & Co. on the Cuyuna range, died suddenly in Detroit on March 21.

LETTERS

The Editor:

I note that in the article, "Low-Cost Production of Zinc Dust from Oxidized Ores" (E&MJ, March, p. 72), two important references have been omitted. The work was a direct continuation of that described in Electrochemical Society Transactions, Vol. 30 (1916) by H. J. Morgan and O. C. Ralston, and is not entirely new. The main points of the process are covered by U. S. Patent No. 923,411 (June 1, 1909) issued to Cowper-Coles.

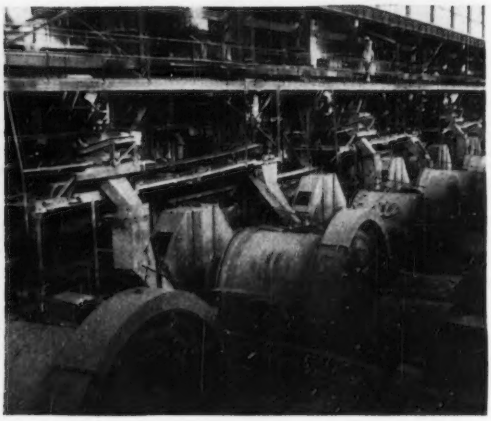
HARRY J. MORGAN
Huntington Park, Calif.

Correction:

In the March, 1950, issue of E&MJ, it was incorrectly stated that **Hugh Leach** was elected chairman of the Minnesota section of the American Institute of Mining & Metallurgical Engineers. The following officers were elected for the year, 1950: **Charles J. O'Connell,** Minneapolis, Minn., chairman; **Grover J. Holt,** Ishpeming, Mich.; vice chairman; **Hugh Leach,** Hibbing, Minn., vice chairman; **Lloyd H. Scofield,** Duluth, Minn., vice-chairman; **Don M. Davidson,** Minneapolis, Minn., secretary-treasurer; **W. L. Taylor, Edward P. Scallon,** and **Richard Whitney,** directors.

AFRICAN COPPER

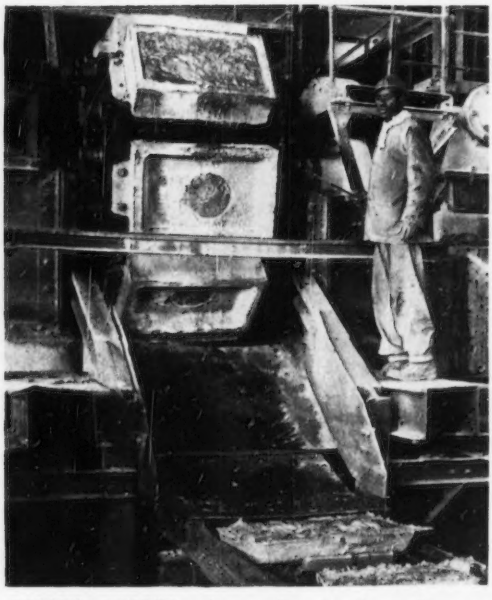
COMPOUND near mine and smelter is a housing development for families of the numerous native laborers.



BALL MILLS prepare the sulphide ore, averaging 3 to 5% copper, for the flotation machines which follow.

Roan Antelope in Northern Rhodesia

STOPING operations are carried on by two machine boys under the supervision of a South African miner. Ore reserves at Roan Antelope were 95 million tons in 1948.



COPPER ANODES, after cooling in the molds, are emptied onto an endless conveyor belt. In 1948 the smelter produced 51,757 tons of blister copper.

IN MINING

IN THE UNITED STATES

- Outlook for Zinc Miners Improves— P. 112
- No Bids Received for Leadville Tunnel — P. 114
- $1,000,000 Perlite Plant Completed — P. 130

ALASKA

★It was reported from Anchorage that **Reynolds Metals Co.** was considering fabrication plant near Anchorage where Army engineers have announced extensive power projects.

★Charles F. Herbert has been elected president of the **Alaska Miners' Association.** He is connected with Wade Creek Dredging Co. and Yukon Placer Mining Co. Vice presidents are R. E. Wyer, Fred K. Dent, John Miscovich, Harold Stranberg, J. A. Williams.

The new executive committee consists of Charles J. Johnston, Ernest N. Patty and James K. Crowdy.

★**Callahan Zinc-Lead Co.** is completing repairs to the tunnel at Livengood Placers property, 90 mi. north of Fairbanks, before water begins to run this spring. The 3,300-ft. tunnel, with a 42-in. continuous redwood stave pipe, brings water from reservoir to placer ground. Activity this summer will be confined to thawing and stripping. The 6-ft., 10,000-yd. capacity bucket dredge has been shut down since 1941.

★Preliminary estimates from the Juneau office of the Bureau of Mines indicates that the value of mineral output has declined from $13,028,000 in 1948 to $11,355,000 in 1949. Here is the breakdown for individual metals:

	1949	1948
Gold (fine oz.).	220,903	248,395
value	$7,731,605	$8,693,825
Silver (oz.)....	36,230	67,341
value	$32,788	$60,947
Copper (tons)..	2	16
value	$788	$6,944
Lead (tons)....	70	392
value	$22,260	$117,782
Zinc (tons)....	0	22
value		$5,852
Total	$7,787,441	$8,885,350

ARIZONA

★A complex lead sulphate mineral, found near the 760-ft. level in the Mammoth mine at Tiger, has been named Wherryite in honor of Edgar T. Wherry, publisher.

★Operations have been resumed at the Trench mine, lead-copper-zinc producer, about 20 mi. east of Patagonia.

★A test hole, 1,000 ft. deep has been started by Boyle Bros. Co. for **Mingus Mountain Mining Co.**, near Jerome.

★**Miami Copper Co.** profits were $2,273,277 for 1949 ($2,280,926 in 1948). Copper production for the Miami properties and **Castle Dome Copper Co.** amounted to 96,553,259 lb. In addition, the company recovered 502,858 lb. of molybdenum and some gold and silver.

★State employment records show Arizona miners are now receiving a higher average weekly pay, $73.83, than workers in other industries. The report showed 12,600 men engaged in mining and quarrying.

★Value of mining production in Arizona for the 1939-49 decade is estimated at $1,294,440,000.

★Production of fluorspar has been resumed with the reopening of the Fluxore mines in the Sierrita Mountains, 25 mi. west of Tucson.

ARKANSAS

★Governor McMath recently announced the transfer of a $250,000 aluminum die casting plant from California to Arkansas and full scale operation of the two **Reynolds Metals Co.** plants located in the state. E. A. Vermere, president of the die casting plant, said he was moving to Arkansas because of lower freight rates and the abundance of labor.

CALIFORNIA

★The Quail gold property southeast of Coulterville in Mariposa County is being worked on a three-shift basis by the **Golden State Mining Co.** The property was rehabilitated and equipped with a ball mill and flotation plant last year, and now 100 tons of profitable ore is reportedly being treated daily. Developed to a depth of about 700 ft. by a 1,000-ft. tunnel, the Quail contains three veins averaging about 4 ft. wide between porphyry and slate.

★Also in Mariposa County, the old workings at the **Marble Springs mine**, east of Coulterville are being reconditioned. Under the supervision of Click Henderson, the former 312-ft. shaft has been deepened 100 ft. Installation of a mill with an 80-ton daily capacity is planned.

★**The Empire-Star Mines Co.** showed a net profit of $152,252 for 1949, but most of the income was from investments rather than gold mining. Mining operations showed an increase of 10% over 1948, largely from leasing operations.

About 30 lessees, employing some 200 men, are mining veins in the Empire, North Star and Pennsylvania mines at Grass Valley, producing a substantial tonnage of gold ore.

★The old **Pacific Mine** dump in Plymouth, Amador County, is being worked with a 300-ton ball mill system by Dr. E. M. Wrightman, C. M. Sayer and Edward Bloyed, who have leased the property.

★**Best Mines Co.** has leased 22 claims in the Brush Creek Mines group in the "Goddyear's Bar area in Sierra County and plans operation on a major scale. The claims form a strip 1,200 ft. wide and ½ mi. long adjoining the Cape Hardy Mine. Lewis L. Huelsdonk, general manager for Best, said a new 2,200-ft. tunnel is planned to develop the property at considerable depth below the presently worked area. Ore will be trucked to the 100-ton ball and flotation mill at the Oxford mine, also under lease to Best.

Best mines is completing rehabilitation of the Gold Bluff property near Downieville.

★Mitchell & Swartz is working placers near Newcastle at the site of the old mining camp of Virginiatown, using a dry-land dredge and washing plant.

E & M J REPORT

Zinc Institute Foresees Good Markets, Concentrate Shortage and Tariff Needs

AT THE ANNUAL MEETING of the American Zinc Institute, held in St. Louis April 11-12, a generally favorable outlook for zinc was portrayed, including maintenance or increases of present prices, and a shortage of concentrates.

The meeting was opened with an exposition by the Institute staff of the constructive work it does to improve markets for zinc.

Dr. Joseph Zimmerman, editor, *Daily Metal Reporter*, analyzed the market outlook, foreseeing a good demand situation for at least several months.

Howard I. Young, president, American Zinc, Lead and Smelting Co., called attention to the importance of maintaining domestic mine production. He predicted a domestic mine output in 1950 of 525-550,000 tons recoverable zinc and a smelter production of 856,000 tons.

James Boyd, director, U. S. Bureau of Mines, considered the long-range outlook for zinc mining good, despite near-term difficulties, including the end of stockpile purchasing within a few years. He predicted that the public would support the Marshall Plan and stressed the need for a strong domestic mining industry.

In the market session, E. J. Reynolds, manager, Agricultural Extension Bureau, Carnegie-Illinois Steel Corp., stated that aluminum and cement block construction are in the farm building field to stay and that a nine-year shortage of galvanized sheets has been prejudicial to planning their use. He illustrated how small architectural modifications could improve eye appeal of galvanized sheets.

J. R. Freeman, Jr., technical manager, American Brass Co., pointed out that the percentage of zinc used in brass is gradually declining but that overall demand will grow with an expanding national economy.

R. G. Kenly, manager, Metal Division, The New Jersey Zinc Co., showed how good metallurgical research has created a permanent, growing market for zinc die castings.

F. G. White, technical director, Granite City Steel Co., stated that galvanizing technique, which lagged for many years, has recently been modified to produce greatly improved coatings.

Forecasting an interesting new market for zinc, Dr. Chester, of Poor and Co., described research on the electroplating of bright and corrosion-resistant zinc coatings from cyanide solutions and by the Cronak process. He showed specimens as bright as nickel and chromium platings.

An interesting and authoritative analysis of the world zinc picture was given by R. L. Wilcox, chief, Non-ferrous Metals Branch, Economic Cooperation Administration. He portrayed concentrate stocks as having decreased by 105,000 metric tons and mine production as being 262,000 metric tons below smelter production in 1949. Western Europe was estimated to have required from outside itself and dependencies 233,000 metric tons as concentrate and 82,000 metric tons as metal. Western Europe's anticipated production was given at 378,000 metric tons mine and 711,000 metric tons smelter. Mr. Wilcox predicted that the price of zinc would hold or gain, and that Europe would still be somewhat deficient after the expected gains.

Paul Jessup, vice president, Day Mines, Inc., denounced the concept of free trade. He justified tariff protection on the basis of national security and stated that the loss of tariff protection would be ruinous to domestic mining.

Senator George Malone (Rep. Nev.) strongly attacked the bipartisan foreign policy, the reciprocal trade program, ECA and the International Trade Organization as a systematic plan for undermining American well being by transferring Congress' responsibility for regulating the domestic economy, first to the State Department and then to an international group. He advocated a system of flexible import fees, increasing with declining prices, as a sound method of protecting American mining and smelting.

The meeting was well attended from zinc areas all over the country.

California *(Continued)*

★U. S. Bureau of Mines is diamond drilling to discover the depth and value of antimony orebodies in the **Cordero Mining Co.** property in the Lone Tree district 18 mi. northwest of Hollister.

Cordero has been exploring the property with a small crew for about three years and has completed a 1,500-ft. drift on the vein. S. H. Williston, vice president, reported that there was a large tonnage low-grade antimony ore there—ranging from 2 to 4%—but that it could not be mined profitably at present prices and under present conditions.

★Substantial operation of several gold properties in the Sierra Buttes district in Sierra County is scheduled within the next few months.

Sierra Monarch Gold Mining Co. is planning to mill 100 tons of ore daily at its Monarch property. **Ace High Mining Corp.** has rehabilitated the nearby Keystones and three stamps are crushing gold ore. Ernest Gastongay and associates have installed a dragline dredger at gold placers above Sierra City. The American Exchange and Primrose mines also are active.

★A deposit of manganese ore at Chapparel Hill near Etna in Siskiyou County is being explored extensively under the direction of C. W. Jenkins. Several carloads of high-grade manganese have been shipped from the deposit.

★**Julian Milling Co.** plans to reopen work on a 115-ft. shaft expected to lead to a millable gold vein near Julian in southern California.

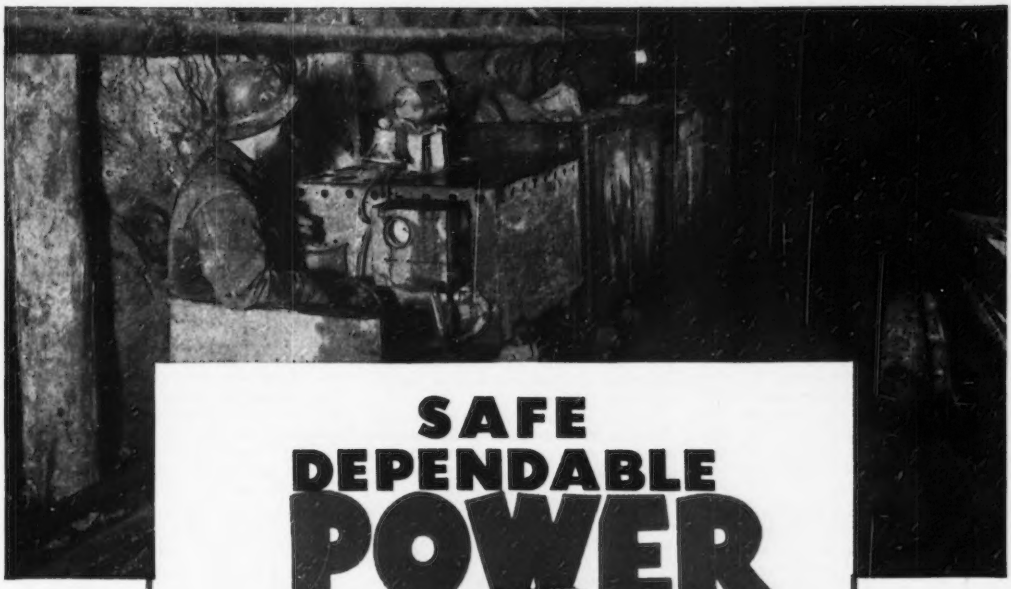
★The feldspar mill and quarry at Campo in San Diego County has been sold by American Radiator & Standard Sanitary Co. to a newly organized company, **Campo Milling Corp.**

The new owners, with Thomas J. Williams as president, are placing the mill in operation under the direction of B. F. Darnell, Alpine. They plan installation of a froth flotation plant for the separation of mica, feldspar and silica. Production would be for a wet ground mica. The plant has been closed for the past eight years because of excessive mining costs.

★The Fresno County Planning Commission has granted permission to dredge gold in the San Joaquin River bed just below the Kerckhoff Dam to O. G. Hesselgren, Jr.

COLORADO

★Engineers and officials of **Consolidated Caribou Silver Mines, Inc.**, entered the Caribou mine to investigate a deposit of uranium-bearing ore recently. The party was headed by Donald M. Nelson, new president of Consolidated Caribou Mines, Inc. Nelson succeeded Boris Pregel as director of the corporation March 1. Others head-



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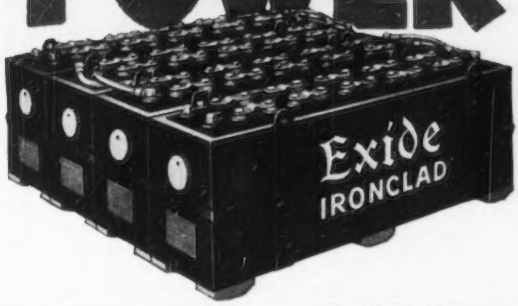

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Colorado *(Continued)*

ing the organization are Richard J. Reynolds, Jr., vice president and director; and Joseph B. Keenan, who is a new director. In the past four years $800,000 has been spent in driving a tunnel to drain water from the flooded mine. Work is to begin immediately in sinking a shaft 100 ft. below the 1,040-ft. level to determine the extent of the deposit.

★**Patti Rosa mine,** on Bull Hill at Cripple Creek, has been opened by Mike Doyle for diamond-drill exploration. The shaft and the three levels of the mine are now opened. Mr. Doyle plans to diamond drill the entire mine toward the contact on the east. The surface of the property will be explored in the same direction. Six men are now employed at the mine which is operated under the name of The Doyle Diamond Drilling Co. The Patti Rose mine is owned by **United Gold Mines Co.** and is under lease to Mr. Doyle.

★Fear over tunneling hazards in soft, water soaked formation of limestones and shales was the apparent factor for the entire lack of bids on construction of the **Leadville Drainage Tunnel.** John H. East, Jr., regional director of the U. S. Bureau of Mines, reported that not a single bid was received at the Bureau's Denver office by deadline time. Mr. East had sent requests to 55 tunnel contractors throughout the country asking for bids on continuing the tunnel which was started in 1943 and discontinued in 1945. Congress has voted more money to advance the bore.

★**Cresson Consolidated Gold Mining & Milling Co.** of Cripple Creek produced ore worth $193,960 in 1949, accounting to Merrill E. Shoup, company president. Net profit for the year amounted to $14,679. Production in 1949 was about 9,700 tons of ore. During the present shutdown, Cresson is installing a Nordberg hoist purchased from the Plymouth mine in northern California. This will operate to a depth of 5,000 ft. Deepening of the Cresson shaft will start when work is resumed in the fall.

★A large deposit of manganese ore will be developed in the Westcliffe area of Custer County. Harold Adams of the **Adams Drilling Co.,** of Brush, Colo., announced that the owners plan to build a $100,000 processing mill in the area.

FLORIDA

★A $4,000,000 expansion program is soon to be started at Bartow by **International Minerals and Chemical Corp.,** it was announced by Louis Ware, president. Included in the project will be a new office building to house the Florida headquarters, the company having outgrown the present headquarters at Mulberry.

In addition to the office building the company plans a new plant for the manufacture of multiple superphosphate and phosphate chemicals; a large new sulphuric acid plant; a modern machine shop, warehouse and service center, and an analytical laboratory.

IDAHO

★**Sullivan Mining Co.** has purchased control of **Metaline & Pine Creek Mining Co.** in the Metaline mining district for $74,581.70, thus closing an option which the Sullivan company has held for several years. During this time about $100,000 has been expended in diamond drilling on the property.

The Sullivan company also concluded a 20-year leasing and operating agreement with **Metaline Mining & Leasing Co.** in the same district on a 50-50 division-of-profits basis.

In 1948 the Sullivan company made its first major investment in the Metaline field by purchasing control of the major interest in **Pend Oreille Mines & Metals Co.** for $3.5 million involving mining property in the Metaline area and the Reeves-MacDonald mine in British Columbia.

★**Bunker Hill & Sullivan Mining and Concentrating Co.** has temporarily suspended its mass-mining project in low-grade ore blocks because of the low price of lead. The project attained production of 1,000 tons per day before it was compelled to stop.

J. B. Haffner, general manager of Bunker Hill & Sullivan, favors an increased import tax on lead and lead ores to offset currency devaluations as a solution for current low domestic lead prices. Most lead imports are coming in from countries which have devalued their currencies up to 40%, he said. January lead imports totaled 30,000 tons, compared to domestic mine production of 33,000 tons, he pointed out, and the price of lead dropped to 11c. [subsequently to 10.5 c.]

Foreign producers can sell their lead for 10c. per lb. in the United States, pay the import duty of 1.06c. per lb. and still receive the equivalent of 12.5c. per lb. for lead, he explained in illustrating how foreign currencies affect domestic prices. Operating costs of foreign producers, he continued, have not been increased through devaluation and that is why they can afford to sell lead at decreased prices in this country. Because reciprocal trade agreements take no account of the devaluation of foreign currencies, he said "our only protection against this unfair competition, as matters now stand, would be a compensatory tax on importation of lead and other commodities similarly suffering, based on the rate of exchange in effect with the particular foreign country at the time of importation."

★**Sunshine Mining Co.** abandoned development work prospecting for uranium on ground owned by Elkhorn Mining Co. near Boulder, Mont. The project was carried out as originally planned but resulted in the finding of only a few samples of uranium ore.

★**Highland-Surprise Mining Co.,** on Pine Creek, reports increased lead content in an orebody opened up on the 1,300-ft. level. A 6-ft. channel sample across 6 ft. yielded 11.2% lead, and 4.7% zinc, according to Frank J. Luedke, president. Average grade of ore for higher levels runs about 7% zinc and 2% lead.

★**Silver Summit** has recently shipped three carloads of concentrates from development ore which averaged more than 1,000 oz. silver and 20% copper. The shipment netted the company $113,780. The Polaris-Silver Summit company has developed this orebody for 800 ft. on the 3,000-ft. level and is now opening the same orebody on the 3,200 and 2,400-ft. levels.

★**Sullivan zinc plant** at Kellogg is now producing 4,600 tons of refined slab zinc monthly and currently employing about 375 men, according to Wallace G. Wolff, general manager.

★**Senator Silver-Lead Mining Co.,** in the Murray district, will custom-mill its ore at the Golden Chest mill in Murray. Recent test runs at the Bunker Hill plant on this ore were reported to be successful.

★**Federal Mining & Smelting Co.'s** annual report for 1949 shows a net profit of $1,752,417 as compared with $2,342,568 for 1948. The 1949 profits were derived almost entirely from operations in the Coeur d'Alene district. The company's Page mine at Kellogg produced 154,230 tons of ore averaging 4.03 oz. silver, 6.87% lead, and 7.13% zinc per ton. Ore reserves as of Dec. 31 were estimated at 911,026 tons. The company is now opening the mine on the 2,770-ft. level.

The Frisco mine produced 48,572 tons of ore averaging 1.39 oz. silver, 4.43% lead, and 6.69% zinc. Ore reserves were estimated at 196,080 tons.

The Morning mine is operating on the 4,850-ft. level and considered the deepest lead mine in the world. Production from the Morning vein totaled 87,750 tons in 1949 averaging 2.1 oz. silver, 6.9% lead, and 8.2% zinc. Ore reserves above the 4,850-ft. level were estimated at 269,000 tons, limiting the life of the mine to about three years operation unless the shaft is deepened.

IRON COUNTRY

★Letters have been received by approximately 90 residents of North Hibbing informing them that the buildings they occupy must be razed or moved in the next few months, as the land will be required for mining. The

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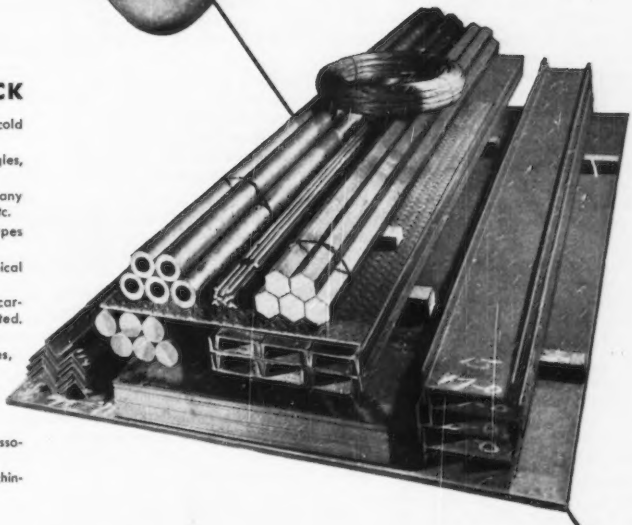

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Iron Country *(Continued)*

Oliver Iron Mining Co. states that occupants may have the buildings without cost. They are owned by the North Hibbing Purchase Committee.

★**Inter-State Iron Co.,** which is converting the Schley underground mine at Gilbert into an open pit, will employ a skip hoist to raise ore from the pit as is done at the South Agnew mine at Hibbing. This arrangement ties up less bank than does the belt conveyor, which must operate on a flatter slope. Regular shipments are expected by 1951.

★**M. A. Hanna's** Butler Brothers group of mines moved 717,000 cu. yd. of surface and rock during February. The Patrick group at Cooley handled 305,155 cu. yd. of the total and the Weggum at Hibbing, 158,700 cu. yd. The Argonne, near Nashwauk, completed its surface stripping and began moving taconite.

★One more mine on the Mesabi is being added to the list of those which raise the ore from pit to surface by belt conveyor. **Pickands Mather & Co.** is installing an 1,100-ft. belt, 30 in. wide, at its Danube mine at Bovey. The belt will operate on an incline of about 12 deg. The lift will be 210 ft. to a 200-ton surface pocket. Locomotives will haul the ore 3 miles to the concentrator.

★**Pickands, Mather & Co.** is considering plans for a large taconite processing plant near Aurora, stated W. K. Montague, attorney for the company, to the St. Louis county board. He said two years of engineering study might be required to complete the plans and he again emphasized the need for an assured water supply of 10,000 gpm. The first unit of the full-scale plant would be for 2½-million tons capacity, additional unit to be built to give 10-million tons capacity eventually. Costs are estimated at $10 to $14 per ton of capacity.

★**Inter-State Iron Co.'s** Longyear mine has broken about 55,000 cu. yd. of taconite capping to expose the good ore below it. This work required 103 holes 25 to 35 ft. deep and 38,500 lb. of dynamite.

★**Inland Steel Co.'s** Armour No. 1 and No. 2, at Ironton on the Cuyuna range, have been busy during the winter. No. 1 has been mining underground and stockpiling. No. 2 has done stripping at the new open pit.

★Ore shipments scheduled by **Inter-State Iron Co.** for shipment in 1950 total over 3 million tons. Of this, the Columbia at Virginia and the Longyear, at Hibbing, are down for about one million each; the Hill-Annex, at Calumet, for 400,000 tons of straight wash ore and 300,000 tons of Heavy-Media product, the latter to be produced after the new plant is completed. This is expected to be not later than Aug. 1. The Grant at Buhl is scheduled for 250,000 to 300,000 tons; the South Longyear, 150,000 tons which will be loaded by M. A. Hanna as exchange ore. Twenty-eight thousand tons from Sullivan No. 2 will be handled by the Hill-Annex organization, stockpiled at the Hill and put through the Hill-Annex concentrator as needed. If enough direct shipping ore can be uncovered, the Schley mine at Gilbert will make its initial appearance as an Inter-State shipper.

★**Pickands, Mather & Co.** and **Erie Mining Co.** were not opposed in their application to take water from Upper Partridge Lake and Knox Creek, run it through a taconite plant at Aurora and return it to lower Partridge Lake. The public hearing was held at Virginia on March 15.

★There were 15 mines, or groups of mines operated as a single property, the 1949 shipments of which exceeded one million tons. All but one were on the Mesabi. The exception was Cleveland Cliff's Mather "A" mine on the Marquette range. Topping the list by a wide margin was Oliver's Hull-Rust-Sellers group at Hibbing with 6,480,839 tons. Oliver's Rouchleau group at Virginia was second with 4,212,650 tons. In third place was Pickands, Mather & Co.'s Mahoning which shipped 2,740,216 tons.

★Inter-State Iron Co.'s Grant mine, at Buhl, is drilling and sampling the mine's tailings basin material, which is mostly minus 65 mesh. Samples are analyzed at the Grant mine laboratory and the balance sent to the Jones & Laughlin Research Laboratory at Negaunee for study as to beneficiation.

★S. J. Groves & Sons Co. is stripping rock at the Mahnomen mine of the **Cuyuna Ore Co.** (Pickands, Mather) at Ironton where P.M.&Co. is also removing surface material by truck. The company is also stripping at the Sagamore at Riverton.

★Dr. G. H. Schwartz, director of the Minnesota Geological Survey, reports that an aerial survey had indicated an iron-bearing formation along an 80-mile belt in northern Otter Tail and southeastern Becker counties. It consists of two connected areas, each shaped like a horseshoe, with the open end to the east. The one in Otter Tail county is about 50 miles long, that in Becker county about 30 miles. Together the two formations form a great "E." Dr. Schwartz believed the area could very probably reveal deposits of commercial ore. The glacial drift covering is 190 to 300 ft. deep, requiring exploration by core drilling. The formations are in the west central part of Minnesota, 65 to 75 mi. northwest of Brainerd.

★Inter-State Iron Co. has acquired lands for disposal of waste material from the Bruce mine, between Chisholm and Fraser. Lands for dumps are becoming increasingly difficult to obtain without necessitating an almost prohibitively long haul.

★Shipment from Inter-State's Grant mine in 1950—250,000 to 300,000 tons—will be largely concentrates: wash ore and Heavy Media concentrate. Fines from the Heavy-Media plant (minus ⅛ in.) will be treated in a Dorr classifier with a recovery of 50 to 55%.

★J. C. Rhude, Duluth, is president of the **Rhude Media Co.,** which has a plant on Highway 169, west of Marble. The plant will grind ferro-silicon pigs to a size suitable for use in the various Heavy-Media units now coming into use on the Mesabi and Cuyuna ranges.

★Formal ground-breaking ceremonies were held at Virginia April 4 for **Oliver Iron Mining Co.'s** new agglomeration plant.

★**Pickands, Mather & Co.** has discontinued an underground development program that was under way at its James mine in the Iron River district. Fourteen miners were laid off and the James is now working day-shift only. The reason given was a decline in demand for the ore of this mine.

★**Inter-State Iron Co.'s** Vicar mine at Wakefield has operated two years with no disabling injury, winning a Safety Plaque and medallion.

★**Montreal Mining Co.** is offering its third four-year scholarship in mining engineering at the Michigan College of Mining & Technology at Houghton. The scholarship is worth about $2,000 and is open to students of Gogebic County, Michigan, and Iron County, Wisconsin, who are sons of former employees whose service was terminated by death, retirement or total disability. In all there are 800 annual scholarships available from various sources to prospective students at MCM.

★Richard Johns, mine inspector for Marquette County, in his report for 1949, notes the return of the Champion mine to production after idleness for 40 years. The mine is now being operated by North Range Mining Co.

★**Cleveland-Cliffs'** Mather "A" mine, at Ishpeming, has set up a tentative schedule for 1950 of 1,200,000 tons; an additional 40,000 tons is to come from development work at the Mather "B." The latter is expected to become a much larger producer in 1951.

★**Cleveland-Cliffs'** Spies mine shipped the first ore from the Menominee range (and, as far as known, from the Lake Superior district) on March 27. The first boat for Spies ore was expected to reach Escanaba about April 10.

KENTUCKY-ILLINOIS

★**Crystal Fluorspar Co.** has suspended operation at its mine in the Cave-in-Rock district for an indefinite period because of high water from the

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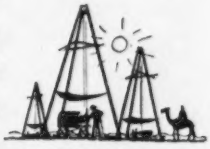
SCOTLAND—Foundation testing.
Hydro Electric Board of Scotland, Loch Fannich, Ross-shire.

INDIA—Gold core drilling.
Mysore Gold Mining Co., Ltd., Marikuppam, India.



FRENCH MOROCCO—Base metal core drilling.
Mines de Bou Skour, Ouarsasate, French Morocco.

BRITISH GUIANA—Sampling.
Demerara Bauxite Co. Ltd., MacKenzie, British Guiana.

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Kentucky-Illinois (*Continued*)

"Big Sink," a landlocked area covering 800 acres in Hardin County, Illinois. Water from a drainage area of 4,000 acres, collecting in the "Sink," has seeped into the mine through underground crevices and fissures to such extent that it is impossible to keep it unwatered, according to D. G. Gibson, manager. Pumping was abandoned when it reached a point of merely circulating the water.

Suspension of operation will interrupt normal annual production at the Crystal of 20,000 finished tons of metallurgical grade fluorspar.

Crystal Co. will continue development at its Jefferson mine. A 180-ft. shaft is being sunk to connect with a winze to permit mining at a 380-ft. level.

★**Rosiclare Lead and Fluorspar Mining Co.** has resumed production at its Rosiclare mine after being shut down by Ohio river flood waters. Pumping to the 300-ft. level cleared the upper mine workings for renewed production.

Headwater from recent heavy rains shut down operation at the Railroad shaft on the Rosiclare Co.'s Pigmy property in the Kentucky district, near Mexico, but pumping has now been started. Rains interrupted work for two months at the new 250-ft. Hoptown shaft at the Pigmy mine, but pumping also has been started there. The shaft is down 170 ft.

★After being closed down for a week during installation of a new smokestack, **Alcoa Mining Co.** at Rosiclare has resumed operation.

MICHIGAN

★At a public auction, the **Copper Range Co.** bought approximately 1,590 acres of land owned by **Isle Royale Copper Co.** The price paid was $1,500, which included mineral and surface rights.

★The average grade of copper rock produced by **Calumet & Hecla** in February was 18.88 lb. of copper per ton of rock treated. This was a slight improvement over the preceding month. Every effort is being made to improve the grade of ore hoisted because of high prices for underground equipment and supplies.

Development work in February was satisfactory. At Centennial, the 23rd level south drift was in fair ground most of the month, and the 45th level north drift was in average ground. At Peninsula No. 4 shaft the 41st level north drift was in lean ground, and the 25th level north at Seneca was in average rock. The 26th level north was in copper most of the month. The 18th level north at Iroquois was in mineralized ground nearly all month. The 18th level north at Allouez was in good copper most of the month. Work on the Iroquois raise at Allouez from

the 12th to the 6th level is nearly complete, with stripping of the 6th level drift to start soon. Development work at No. 4 North Kearsage was started this month by drifting south on the 35th level.

Since the fall of 1948, Calumet & Hecla's reclamation plant at Lake Linden has been treating a large tonnage of slime which settled over a large area in Torch Lake. The slime is pumped directly into the leaching plant classifying system. Elimination of the regrinding and shore plants has reduced the treatment cost enough so that there is still a fair profit on the reduced scale of operation. A small tonnage of sand is treated in the leaching plant, but the larger part, consisting of fine slimes, is treated in the flotation plant. Severe ice conditions the past winter have greatly hampered the operation of the dredge, but after the ice goes the dredge should be able to keep the plant supplied with feed throughout the summer and possibly longer. After 33 years of operation, the conglomerate tailing in the lake had all been treated in the reclamation plant by the fall of 1948, when the slimes operations were started.

★Crushing experts and Calumet & Hecla engineers are investigating possibilities of finding a more economical way of crushing copper rock in the Ahmeek mill. A Bulldog hammermill was recently installed on an experimental basis to determine its merits. Equipped with hammers made of Calumet & Hecla Ni-Hard, the reduction accomplished by the unit was satisfactory, but a study is now being made to determine the cost of maintenance of equipment such as hammers, liners, etc. Experts from Jeffrey, Allis-Chalmers, New Holland, Sturtevant and Nordberg, are studying the problem. Lippmann Engineering, and others, are being contacted.

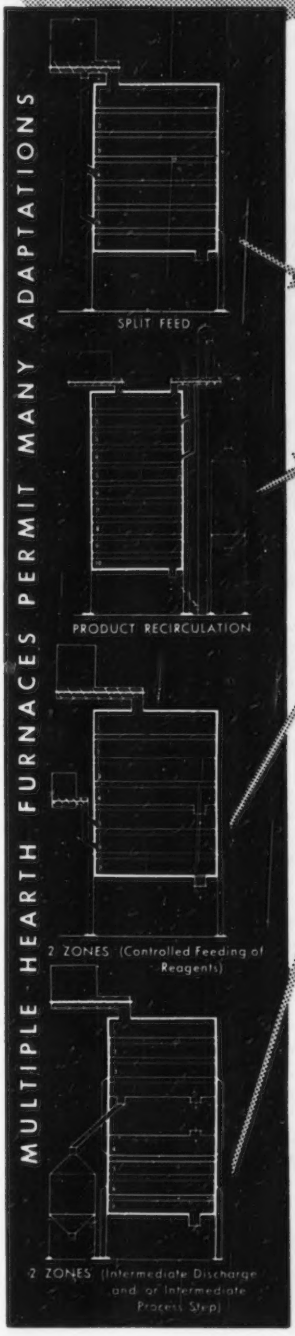
★Preparations are being made in **Quincy Mining Co.'s** smelter to start up its No. 5 furnace, long dormant. One of the smaller type reverberatory furnaces is now in commission. The company's reclamation plant at Mason is producing more concentrate than the present small furnace can handle. As a result, a heavy backlog of mineral has accumulated. The additional furnace will be ready, it is expected, in three months. The furnace is equipped with a rotary casting table and was an important unit in Quincy's production prior to 1934.

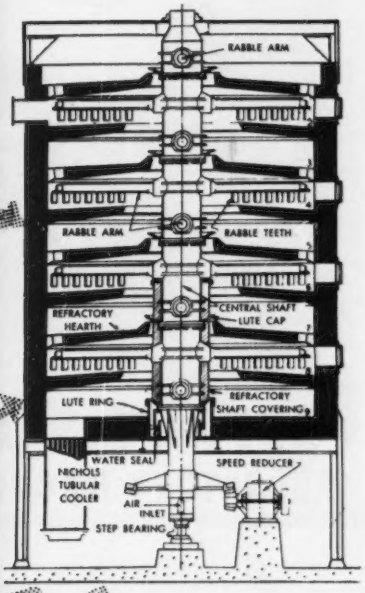
MONTANA

★By a heavy affirmative vote, members of four Mine, Mill and Smelter Workers unions approved a contract with the **Anaconda Copper Mining Co.** An increase of 5c an hour, effective March 1, and increased hospital and medical contract contributions by the company are among the terms accepted by the Butte Miners Union

NICHOLS

MULTIPLE HEARTH FURNACES


MULTIPLE HEARTH FURNACES PERMIT MANY ADAPTATIONS
SPLIT FEED
PRODUCT RECIRCULATION
2 ZONES (Controlled Feeding of Reagents)
2 ZONES (Intermediate Discharge and of Intermediate Process Step)



Flow control of materials as well as flow control of gases are inherent in the design and construction of Nichols Multiple Hearth Furnaces—Herreshoff and Wedge types. The illustrations at the left exemplify some adaptations for controlling the flow of solids,—numerous combinations of gas flow, materials flow, with direct or indirect heat supply are available.

Ad. No. 4 of a series on special designs. Watch for No. 5

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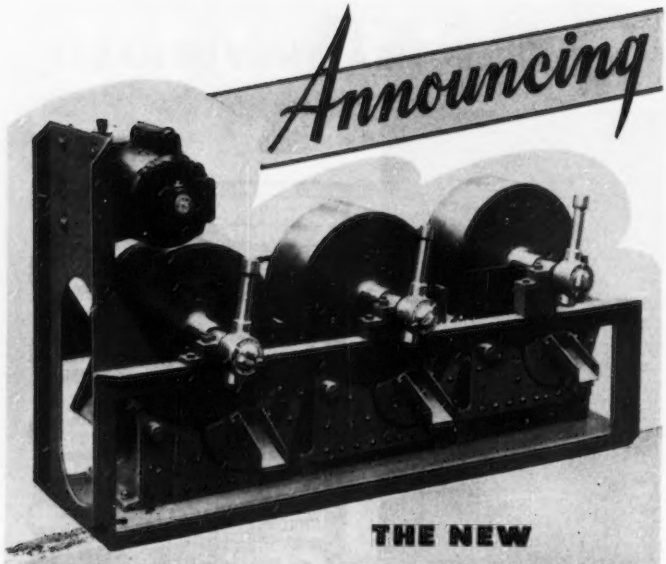

Announcing

THE NEW

JEFFREY-STEFFENSEN

LABORATORY MAGNETIC SEPARATOR

For the concentration and recovery of finely ground magnetite or ferro-silicon in mineral dressing laboratories, Jeffrey has developed a NEW laboratory unit, employing the patented Jeffrey-Steffensen counterflow principle of magnetic separation.

In actual tests on pilot plant and production basis, the Jeffrey-Steffensen Magnetic Separator has proven itself superior for the production of slime-free concentrates of the highest possible grade from fine feeds.

The Type 125 Laboratory Separator shown above offers a COMPLETE TOOL for research and development of this nature.

Features:

Unit is Available in 1, 2, 3 or more sections. Three-drum size is shown above.

Each section is integral being independent of other sections except for drive. All sections interchangeable.

In the laboratory it is possible to remove one or more sections . . . any number of sections can be used for any given test.

Driving gear motor is mounted above level of the drums themselves so that it is out of all possible splash.

Removable plug in bottom of each section provides a means of cleaning out material from machine at end of each test.

Additional data upon request.

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Montana *(Continued)*

No. 1, Great Falls M. & S. Union No. 16, Butte Stationary Eng. Union No. 83, and Anaconda U. & S. Union No. 117. The contract is to extend to June 30, 1951.

★Eleven men have been appointed as members of the Subcommittee on the Development of Mineral Resources of the Columbia Basin Inter-Agency Committee by Herbert M. Peet, chairman of the Inter-Agency Committee. They are F. W. Libbey, Sheldon L. Glover, Carl Trauerman, W. Harold Stuart, A. W. Fahrenwald, Samuel Moment, R. U. Harmon, M. E. Volin, A. E. Weissanborn, Elton M. Hattan and Dr. Horace D. Thomas.

★Members of the AIME have been invited to participate in the eleventh summer convention of the Mining Association of Montana at the Finlen Hotel, Butte, July 30 and 31. A. B. Martin, chairman of the Montana Section AIME, will be toastmaster at the final banquet. Members of the Butte Entertainment committee are R. C. Sherman, chairman, Austin Ganyaw and Roy A. McCready. W. R. Allen, former Lieutenant Governor of Montana, is chairman of the resolutions committee.

★**Commonwealth Lead Mining Co.**, has recently finished sinking a winze 237 ft. along the foot wall of the Calvin lime bed east of Melrose. The winze opened some milling grade oxidized lead and silver ore. J. F. Featherstone, president and general manager, announces that a raise will be driven to the hanging wall side of the orebody, where sulphides are expected to be found.

★**Signal Mining Co.** of Kellogg, Idaho, has taken a lease and bond on 28 mining claims owned by the **New York & Montana Mining Co.** and the Shenon family, near Bannack. The property, which is 20 mi. west of Dillon, is equipped with a 125-ton continuous decantation cyanide plant. Operations are expected to start immediately at the Bannack gold properties under the direction of Frank Eichelberger.

★Four cars of gold ore are being shipped weekly from the No. 3 level of the U. S. Grant mine according to Walter H. Myers, president and general manager of the **U. S. Grant Mining Co.** A 600-ft. crosscut driven from the No. 1 level of that mine to the old E. Fleda property has encountered rich gold ore in the latter, and shipments are being made from it.

★**Silverton Mines, Inc.**, which started operating the old Cumberland lead mine near White Sulphur Springs last year, reports striking a substantial body of milling grade ore. The Cumberland was last operated in 1893. Alex Pugh is in charge of operations, and Arthur Lakes is supervising geological work.

★**Martin Mining Co.**, which has been

working on a silver property in the Hog Heaven district, 32 mi. southwest of Kalispell, expects to erect a 100-ton flotation plant in 1950.

★**Elkhorn Mining Co.** reports opening a virgin lead-silver orebody 200 ft. below the surface on the foot wall side of the Sophia shaft at the old Elkhorn mine. Wade V. Lewis is president and general manager.

★A drop of nearly 300 accidental injuries in Montana industries during January and February as compared with these two months in 1949 has been reported by Walter P. Coombs, chairman of the State Industrial Accident Board and president of the Montana Safety Council.

★A description of his recent trip through the eleven Western states and to Washington, D. C., in behalf of the small mining industry by Carl J. Trauerman, secretary of the Mining Association of Montana, and election of officers were featured at the annual spring dinner of the Last Chance Gulch Mining Association, Helena chapter of the Mining Association of Montana, in March. Officers for 1950 are Alfred E. Nugent, president; Stanley M. Lane, vice president in charge of programs; A. Ray Johnson, vice president in charge of membership; Carlos A. Hieber, secretary-treasurer. Charles R. Brazier was re-elected vice president in charge of publicity.

★**Sunshine Mining Co.** is pulling the pumps and removing the machinery on the New Enterprise group of prospective uranium claims near Boulder according to reports from Wallace, Idaho.

NEVADA

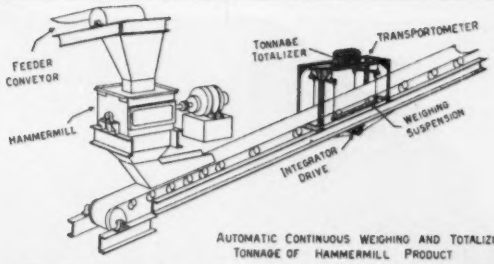
★L. O. Hawkins and associates, Las Vegas, have taken a lease and option on an area about 2 mi. wide and 4 mi. long in the Eldorado Canyon-Searchlight area of Clark County.

★Work being done by **Newmont Mining Co.** in its deep mines operation of the White Horse claim in Esmeralda County centers chiefly on sinking a winze on the vein first opened several years ago. The work is being done in a new mineralized area of the district. On the strength of it a 100-ton mill has been built on the site of the old Florence mill.

Newmont miners are now breaking mill-grade ore over a width of 17 ft. The bottom of the winze is reported at 500 ft.

★Officials of the Nevada Mines Division, **Kennecott Copper Corp.**, and the Mine, Mill and Smelter Workers Union (CIO) signed a new contract at McGill on March 1. It runs for 18 months to June 30, 1951, and calls for a 5c.-per-hour wage increase retroactive to an unannounced date.

(*Turn to page 128 for more mining news*)



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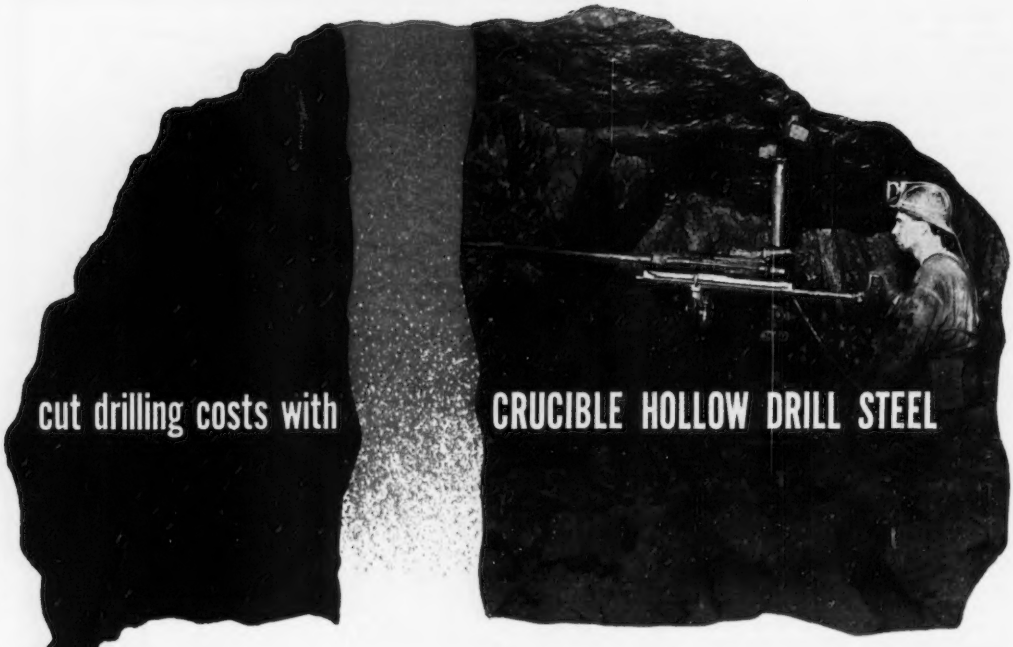
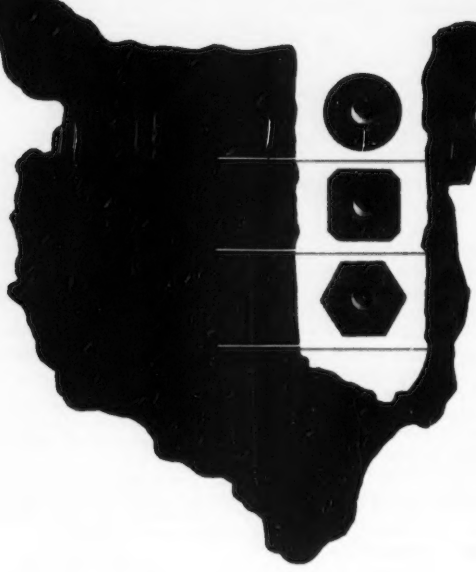


cut drilling costs with CRUCIBLE HOLLOW DRILL STEEL



Lower cost per foot drilled is what you want. And *lower cost per foot drilled* is what you get with Crucible Hollow Drill Steel. Controlled hardenability, excellence of stress-bearing surfaces and uniform processing all contribute to the assurance that Crucible Hollow Drill Steel will cut costs in your drilling operation.

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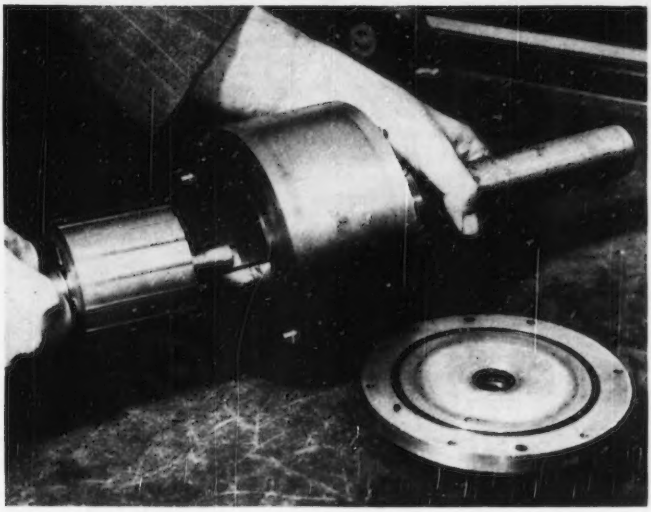
NEW PRODUCTS DIGEST

For further information on these products, circle item numbers on card—insert and mail.

PREVIEW



LIQUID which can instantly turn into a solid, then back to a liquid is the basic feature of this clutch, capable of lifting one ton, 1,000 fpm. (1)

Magnetic-Fluid Clutch Packs Power

A LIQUID WHICH CAN INSTANTLY CHANGE to a solid and then return to a liquid again is the basic feature of an improved magnetic fluid-clutch built by General Electric Co. engineers. Only 6 in. long and 6 in. in diameter, the device is capable of carrying enough power to lift one ton 1,000 ft. per minute.

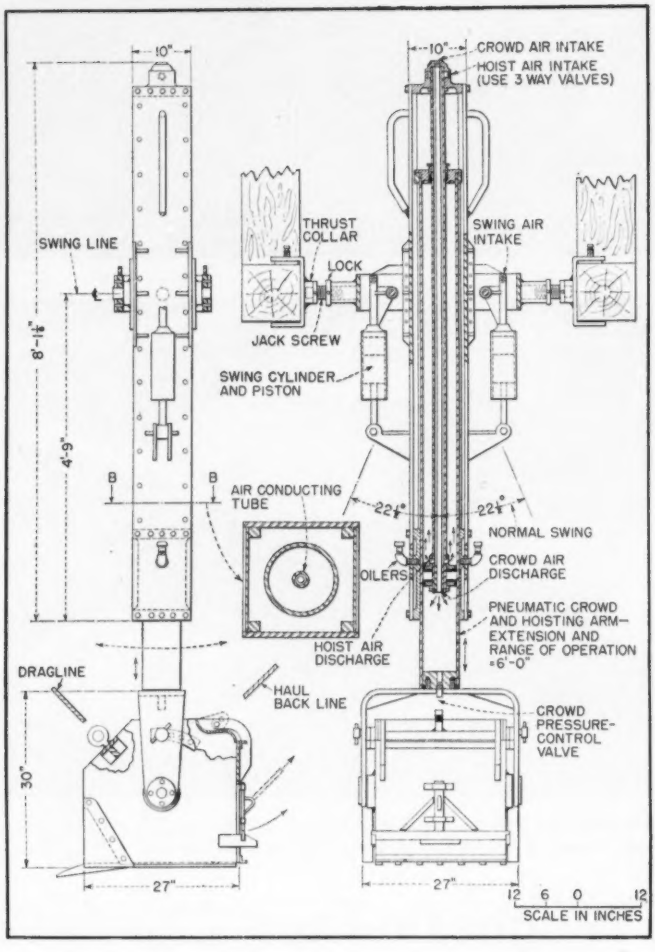
Consisting of two metal cylinders, each able to rotate independently on the same axis, the clutch transmits rotary power from its source to the load. The cylinders are separated by a magnetic mixture of oil and finely divided iron powder.

When the unit is energized, the fluid instantly solidifies, making a rigid connection between the two cylinders so that the motion of one is transmitted to the other. Degree of rigidity of the magnetic fluid can be varied by regulating the energizing current. In this way the clutch can be allowed to slip if necessary.

Kenneth E. Wakefield and Mason Kronick, development engineers, worked with the same basic type of clutch developed by the National Bureau of Standards. They have equipped their model however with rectangular teeth on the surfaces of the clutch faces. This permits a smaller model to carry a heavier load.

The General Electric fluid-clutch is still in the laboratory stage, and commercial possibilities have not yet been explored.

For further information on this development, circle No. 1 on the card opposite page 126, and mail, postage free, to E&MJ.



Compressed Air Powers New Shaft Mucker (2)

Our Idaho correspondent first put the bee in our ear about this new shaft mucker. As soon as we read the brief item in his news letter (E&MJ 1950, p. 117), we wrote to Inventor J. V. Grismer of Wallace for more details. Mr. Grismer's reply was such a fine job, complete and concise, that we are passing it along "as is."

CALLAHAN CONSOLIDATED MINES INC.
GYDE-TAYLOR BUILDING
WALLACE, IDAHO

Engineering and Mining Journal
330 W. 42nd Street
New York 18, N. Y.

Dear Sirs:

Complying with your recent request I wish to submit the following:

After a great deal of experience in shaft sinking I realized the need for a mechanical shaft mucker. I also realized that this mucker must be so designed that it could work below timbers and inside of timbers where soft ground required close timbering. I decided that a dipper attached to a pneumatic hoist and

crowd arm would be the machine best suited for this purpose.

The engineering staff of the Diamond Drill Contracting Co., Spokane, Washington, designed the first machine and built it in their shop. The machine has an outer casing 10x10 in. in which the control mechanism of a 6-in. crowd and hoist arm slides. The arm has an extension and range of operation of 6 ft. and its hoisting and crowding motions are controlled by one 1-in. three-way valve. Crowding pressure with 80 psi. of air is 2,260 lb., while the hoisting power is 1,945 lb. The crowd arm has a square cylinder head which slides on four 1-in. guides inside the housing and keeps the dipper in line at all times. Two swing cylinders and pistons, one on each side of the machine, control the side motion of the dipper and permit the clearance of an area 7 ft. wide. These two cylinders are controlled by one ½-in. three-way valve and the dipper can be spotted within one inch of where desired.

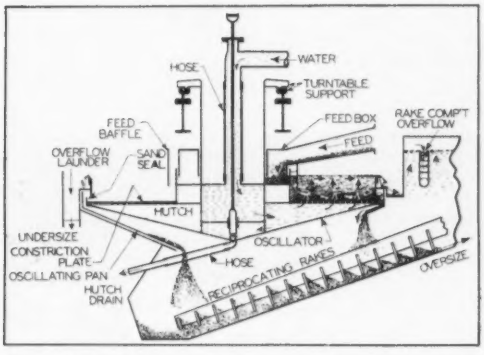
The outer housing is set in a frame which permits the machine to swing sideways, forward and backward in regular shoveling operations. The frame is attached to the bottom of a cage or can be attached to a set of timber in which case it is necessary to hoist the machine several sets when blasting.

A Gardner-Denver Model MBB reversible air motor is mounted on the front of the lower end of the outer housing from which a ⅜-in. cable extends through an 8-in. sheave which is chained to an end plate of the shaft timbers and back to dipper. This air motor is the digging motor. This particular motor was selected after it was proved that a more powerful motor was too fast for safety. A similar or smaller motor is mounted on back of the digging motor for a pull back motor.

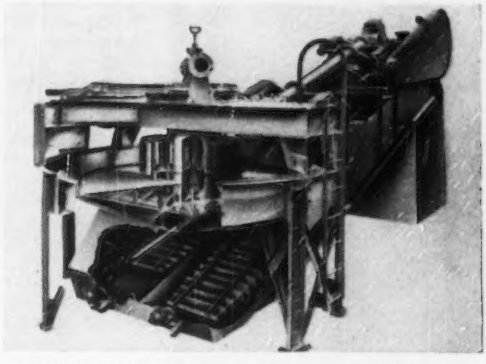
The operating range from axis of swing to bottom of the dipper with crowder arm extended, is 13 ft. 3 in. Weight of the machine, without motors mounted, is 1,980 lb. It requires a shaft length of not less than 12 ft. to be successfully operated. The dipper on the machine is of 8-ft. capacity and is so designed that it can be tipped to any angle required to suit the job. A Gardner-Denver Model GE-9 mucking machine dipper lip is used on this dipper and is easily changed when worn out. The machine is operated by one man but requires one man in the bottom to spot the hoisting buckets.

Engineers of the Diamond Drill Contracting Co. are designing a pneumatic clam shell which can be used in place of the dipper. The machine may then be used in small shafts. The clam shell is to be designed so that it will operate with two air cylinders and will require no pulleys or cables. The Diamond Drill Contracting Co. has the manufacturing rights and is equipped to fill orders upon reasonable notice.

Yours very truly,
(signed) J. V. Grismer, Supt.



STATIONARY PARTS are represented by solid lines. White dots indicate oscillating members. (3)



HYDROSCILLATOR produces cleaner rake product, closer-than-normal separation of product.

"Hydroscillator" Combines Mechanical, Hydraulic Classifying

"Hydroscillator" is the name given to Dorr Co.'s combined mechanical and hydraulic classifier. The basic principle involved is the stirring up of the settled oversize by upward flowing water and oscillation.

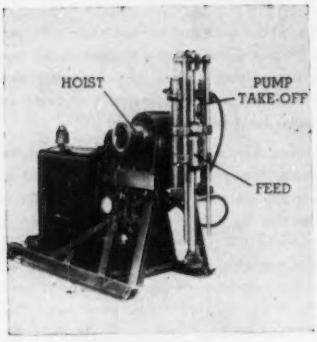
Major parts of the Dorrco Hydroscillator are a shallow, cylindrical, oscillating classifying compartment, and a reciprocating rake dewatering compartment. Oscillation is about a vertical axis. Feed enters the open-bottomed annular feed box at the center. Water is injected into the bottom through perforations in an oscillating constriction plate. This sets up a "teeter bed." Fine particles which have reached the top are swept outward by the radial water flow, and eventually leave the unit as an overflow product across a peripheral weir.

Coarse oversize particles work to the bottom, flow to the periphery of the classifying compartment and pass under a stationary side wall and over an oscillating lip into the reciprocating rake compartment.

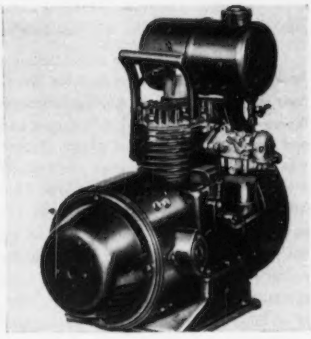
Oversize particles, under the head imposed by the bed of teetering solids, must overcome back pressure set up by the head of water in the rake compartment. The latter can be varied to control the fineness of separation.

The Hydroscillator's higher cost and operating expense are justified where there is definite advantage in producing cleaner-than-normal rake products and in making closer-than-normal separations. One such application is in the closed circuit grinding of certain siliceous ores or ores of low mineral content where definite reductions in grinding mill power should be realized. Another application is the closed circuit grinding of heavy sulphides where reduction in the amount of grinding may be offset by finer grinding of the mineral constituents, but where this finer grinding may result in improvements in subsequent metallurgy.

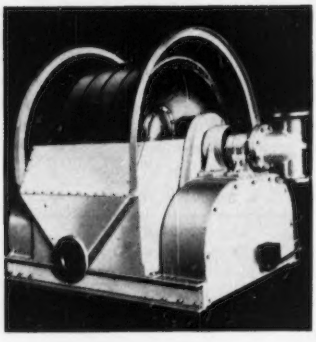
Available: Dorr Co., Stamford, Conn. (Circle No. 3 on card.)



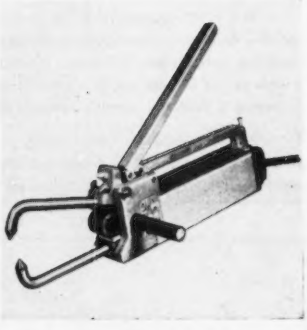
CORE DRILL, light, compact, will drill to depths of 600 ft. Three speed transmission can be used with hydraulic or screw feed. Choose your own power plant. 24-in. drill travel. Trade named Drills at any angle and offers full "Teredo" it provides power take off for pump. Acker Drill Co., Scranton, Pa. (4)



PORTABLE POWER PLANT is rated at 350 watts, weighs 70 lb. Kohler Co., Kohler, Wis. (5)

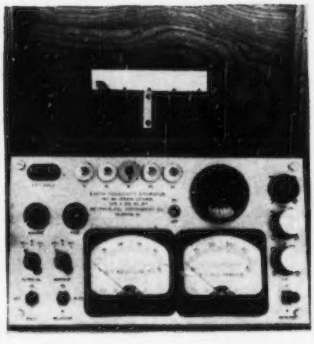


FILTER is especially applicable for dewatering concentrates, flotation tailings. Vacuum is applied through an oversize trunion. Filter cake is entirely removed by pneumatic blow-back. Multi-paneled cylinder eliminates need of wire winding to hold filter medium. Bird Machine Co., S. Walpole, Mass. (6)



SPOT WELDER will spot up to two pieces of 13-gage stainless or mild steel and 2 pieces of 16-gage galvanized. Weighs 30 lb. Uses 220 v. Miller Electric Mfg. Co., Appleton, Wis. (7)

GASOLINE ROCK DRILL weighs 118 lb., will drill down 8 to 10 ft., rotating drill bit. Single cylinder engine drives 2 pistons. One actuates flywheel magneto and fan, the other strikes the shank of the drill steel. Exhaust gas is forced through hollow drill steel to blow cuttings out of the hole. Syntron Co., Homer City, Pa. (8)



EARTH RESISTIVITY APPARATUS is designed for work at less than 300 ft. Compact, moderately priced, uses Wenner 4 electrode method. Geophysical Instrument Co. (9)

CO-DETECTOR uses bulb to draw air over chemicals in pencil size tube. If yellow chemicals turn green in 30 sec., carbon monoxide is present. Detects one part in 500 million. U. S. Safety Service Co., Kansas City. (10)

FLUORESCENCE COMPARATOR permits analysis of mineral samples under ultraviolet light in broad daylight. Operates on flashlight cells, costs $49.50. Menlo Research Lab., Calif. (11)

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

ROOF BOLTING. In Bulletin RB 1, the Elreco Corp. gives a brief factual description of their method of roof bolting along with prices of expander plug and shell used in the operation. (71)

WINCHES. Folder put out by Atlas Corp., Mountville, Pa., describes Fridy Hoists, winches and car spotters. (72)

TRUCK-MOUNTED CRANES. Catalog No. 2322 of the Link-Belt Speeder Corp., Chicago, Ill., will tell you what you want to know about applications, benefits and specifications of the new HC-51 truck-mounted shovel-crane with hydraulic controls. (73)

SCREENS. Details are listed for design of "Bee-Zee" screens for vibrator, shaker, conveyor, centrifugal, heat drier, stationary, rotary, trommel and special applications. Round rod design is discussed. Bixby-Zimmer Engineering Co., Galesburg, Ill. (74)

PORTABLE CABLE. This 56-page manual on Hazacord flexible cables, put out by Okonite Co., Wilkes-Barre, Pa., gives complete technical information and dimensional data from the smallest 300-v. cord to the largest 15,000-v. shovel cable. Included are current carrying capacities, resistance values and correction factors. (75)

CIRCUIT BREAKERS. Booklet tells how Noark Panelettes instantly break short circuits and dangerous overloads but remain unaffected by momentary harmless overloads. Federal Electric Products Co., Newark, N. J. (76)

ROCK-BIT GRINDER. One-page handout from Rip-Bits Ltd., Sheffield, England, describes a 191-lb. unit for off-hand grinding of rock drill bits and drill rod shanks, resharpening of breaker and pick steels, chisels, twist drills. (77)

CRUSHING PLANTS. A 20-page booklet covering its complete line of portable combination 2-unit crushing and screening plants, has been issued by Pioneer Engineering Works, Minneapolis, Minn. (78)

COMPRESSOR. A 15-page bulletin describes Ingersoll-Rand's new line of compact, electric-driven crosshead-type compressors. (79)

RECONDITIONED MACHINERY. Catalog of reconditioned machinery available, from Aerial Tramways and Agitators to Winches and Zinc Boxes. Morse Bros. Machinery Co., Denver, Colo., puts out this 32-page book. (80)

TORQUE CONVERTER. Well illustrated book covers the theory and practical application of General Motors' new diesel engine torque converter unit. Demonstrates its advantages in power transmission. (81)

CRUSHING. "How to Select Motor Drives for Large Crushers and Grinders" is a valuable article appearing in the E-M Synchronizer (Mining Issue), published by Electric Machinery Mfg. Co., Minneapolis, Minn. (82)

SPEED REDUCER. A 16-page brochure augments description with full-size photos. Dodge Mfg. Corp., Mishawaka, Ind. (83)

BUCKET REPAIR. Folder tells how dragline bucket and other wearing parts can be quickly and inexpensively repaired with an 11% to 13½% manganese-nickel steel. Stulz-Sickles Co., Newark, N. J. (84)

PUMPS. Construction details, applications and detailed installation drawings of Economy VSL and VS general service sump pumps are featured in a catalog released by Economy Pumps, Inc., Hamilton, Ohio. (85)

DIESEL ENGINES. Complete specifications of all automotive and industrial models of HR-400 Cummins diesels can be found in bulletin No. 5291, just announced by Cummins Engine Co., Columbus, Ind. (86)

CONVEYOR BELTING CARE. "Installation Care and Maintenance of Rubber Conveyor Belting" is the title of a handy booklet put out by Carlyle Rubber Co., New York N. Y. (87)

PULP DENSITY SCALES. Pulp density, percent solids and conditioning times required for given volumes of pulp can be determined quickly and accurately by means of pulp density scale tables found in two bulletins published by Denver Equipment Co., Denver, Colo., describing their pulp density scales. (88)

SINKER. New Thor Model 35 sinker rock drill is described in Circular JE-1139 with complete tool specifications supplemented by cutaway drawings of integral parts. Another circular, JE-1132 describes and illustrates a new sinker leg, air bar feed, pneumatic column and stoper leg. Independent Pneumatic Tool Co., Aurora, Ill. (89)

ELECTRIC CABLE SPLICING. Bulletins 50 and J50 give complete information and specifications for unit splicing kits for any type of electrical cable joint. G & W Electric Specialty Co., Chicago, Ill. (90)

CORDUROY CLOTH. Frequent requests have prompted E&MJ to compile a list of suppliers of Corduroy cloth for use in milling gold. For a copy of this list, circle No. 91 on the card below. (91)

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to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

May, 1950

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

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2	9	16	32	39	46	72	79	86
3	10	17	33	40	47	73	80	87
4	11	18	34	41	48	74	81	88
5	12	19	35	42	49	75	82	89
6	13	20	36	43	50	76	83	90
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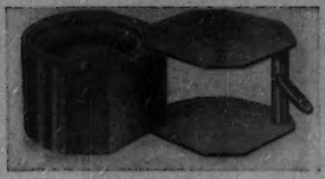
Equipment Shorts



MAGNIFIER. This 10 power Hasting Triplet pocket magnifier for rough field usage is protected by stainless steel frame. Price: $12.00. Available: Stratex Instrument Co., Los Angeles, Cal. (31)

OVERLOAD PREVENTER. Users of slow-speed machinery that can be equipped with American Reduction Drives can automatically protect expensive equipment against heavy shocks, impact and choke load conditions with this mechanical torque-arm overload release. Can be quickly installed without alterations to the drive. Available: American Pulley Co., Philadelphia 29, Pa. (32)

GREASE GUN. Portable electric grease gun, 23 in. high and 27½ in. long is rubber tire mounted. A modified Ford starter motor develops up to 5 hp. on the pump. Thumbscrew adjusts maximum grease pressure from 500 to 12,000 psi. Capacity is 25 lb. of any weight grease. Will grease about 5,000 fittings before battery needs recharging. Available: Maynard Edwards Inc., Charlotte, N. C. (35)

FLEXIBLE COUPLING. Inside sleeve of coupling is made in two parts instead of one, providing a sleeve in each body. Both bodies are machined alike for removable steel collar. Bodies are thus interchangeable, and collar is easy to put on either half of coupling. Made for all machinery from 50 to 1,000 hp. Available: Lovejoy Flexible Coupling Co. (34)

TRI-POINT ROCK DRILLS. Use of vacuum sintered cemented carbide cutting tips in a triangular design is claimed to give added resistance to wear and shock and freedom from packing. For use in air or electric hammer-type drills, the new rock drill penetrated the hardest rock in recent tests. Heat-treated alloy steel drill shanks are from 7⅝-in. to 12 in. long. Diameters range from ⅝ to 1 in. Available: Kennametal Inc., Latrobe, Pa. (35)

TAPE-RULES. "Mezurall" and "Wizard Jr." steel tape-rules now have a chrome-clad non-glare finish. Blades are 100% metal, will not chip, crack or peel and are rust resistant. Black markings on chrome-white are easy to read. Available: Lufkin Rule Co. (36)

HAND TRUCK. Nose plate on "Anco" truck slides under loaded pallet. A slight pull on two handles tilts 1,000-lb. load into perfect balance carrying position for easy loading and unloading of stacks of bagged materials. Available: Anthony Truck Co., Paducah, Ky. (37)

PROTECTIVE COATING. Low cost, chemical and heat resistant aluminum paint, "BiChem R," dries to handle in 12 to 18 min. Bright finish will not stain or yellow. Available: Bisonite Co., Buffalo, N. Y. (38)

PHOTOELECTRIC EYE. New models are cheaper, easier to maintain, use "snap on" covers for easy light replacement. Can be used in smoke detection, as liquid level indicator, prevent overwind and choking of bins, and other uses in mine, mill and smelter. Available: General Electric Co., Schenectady 5, N. Y. (39)

LUBRICANT. "Plastilube," an all purpose lubricant, has no melting point. Besides its non-melting feature, it is very adhesive and is easily pumped at low temperatures. Available: Warren Refining & Chemical Co., Cleveland, Ohio. (40)

TEMPERATURE INDICATOR. "Tempilstik" is used like crayon to mark workpiece with any working temperature from 113 to 2,000 deg. F. When "Tempilstik" mark melts, you know that the work piece is at temperature rating selected. Price: $2.00 each. Available: Burrell Corp., Pittsburgh, Pa. (41)

WIRE ROPE CUTTER. One man can cut wire rope up to 1½ in. diameter in less than a minute with this 112-lb. portable wire rope cutter. Easy to operate unit costs $67.20. Available: Hardypick, Ltd. (42)

PIPE LINE FILTER. The "Marvel Synclinal" filter can be installed at any angle in the pipe line. Incorporates large filtering area in small space and can be disassembled for cleaning by removing one nut. Comes in 5 to 50 gpm. capacities. Over-all height of large model is 15 in., diameter, 5¾ in. Available: Marvel Engineering Co., Chicago 6, Ill. (43)

POCKET DRAFTING MACHINE. "Paraline" measures 10¼ x 3 3/16 in. Combination of precision machined metal moving parts with 32nd in. scale protractor design makes it useful as a T-square, parallel rules, triangle or drafting machine without adjustments or addtional parts. Requires no clamps or board mounting to remain in alignment. Price $4.95. Available: Loomis Industries, Piedmont, Calif. (44)

DRAFTING. Photosensitized cloth (Trade name—Kodagraph Autopositive Cloth) eliminates negative step used in making cloth reproductions of engineering drawings. You can use ink or pencil on either side of the translucent cloth. Available: Eastman Kodak Co., Rochester, N. Y. (45)

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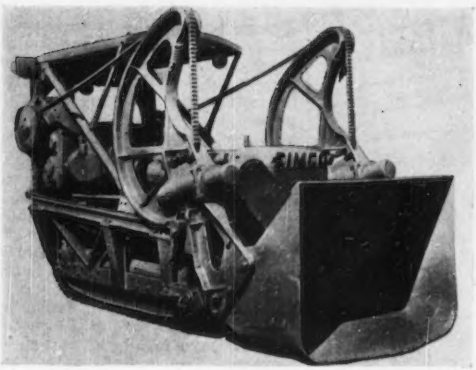
New Rocker Shovel Model Is Crawler-Mounted



Crawler-mounted version of the Eimco RockerShovel is now ready. The tractor-borne loader, employing the rocker-arm principle, throwing the load over head to discharge, can dig and load without having to turn around.

Operating cycle of Model 104, from digging position through loading to discharge and back to digging position, takes from 10 to 15 sec. Equipped with varying sized buckets of from 1 to 2-cu. yd. capacity, the unit is rated at 4 to 6 yd. per min., but achieved 8 yd. and over in recent tests at Salt Lake.

It takes full advantage of the prime mover's 48-hp. diesel engine. Rocker-arms and automatic accelerating reel give maximum power at digging position and maximum speed at the discharge point. Power may also be furnished by a 30-hp. electric motor. Where necessary, the RockerShovel can double as a bulldozer.

Minimum head room for operation is 12 ft. Over-all width is 6 ft.-6 in. For further information circle No. 12 on the card opposite p. 126, and mail.

Available: Eimco Corp., Salt Lake City, Utah.

Memos from the Manufacturers

Kennametal Inc. has appointed **John D. Cook** as a representative in the north Indiana area.

New sales representatives for **Marion Power Shovel Co.** are **Ralph W. Kerr**, Michigan and western Ohio; **William W. Wilkinson**, Kentucky and southern Indiana; **Melvin Kraft**, New York City,

Cambridge Wire Cloth Co. has assigned **J. C. Peters** to the New England territory.

Wagner Electric Corp. has established two more sales offices, one in New Orleans, La., and one in Davenport, Iowa.

T. W. "Ted" Marx has joined Republic Rubber Div., **Lee Rubber and Tire Corp.** as sales representative in the Pacific northwest.

Rock Bit Sales & Service Co. has named **Tom Bono** sales representative in the middle Atlantic territory.

Keith Holbrook will supervise factory sales programs and dealer relations for **Federal Motor Truck Co.** in Utah, Arizona, Nevada, Wyoming and Idaho.

Assistant sales manager **Frank S. Foster** has been transferred from the Eastern to the Western Div. of **Caterpillar Tractor Co.**

R. S. Stevenson has been promoted to general sales manager of Tractor Div. **Allis-Chalmers.**

Managing the Apparatus Dept.'s new midwest sales district has been left up to **G. F. Maughmer** by **General Electric Co.**

Edgar F. Guillot has been named assistant sales manager of **Filtration Engineers Inc.**

New sales manager of the Welding Div. of **Harnischfeger Corp.** is **Melvin O. Monsler.**

Pierce J. Fleming is now manager of Off-Highway Sales Div. **Mack-International Motor Truck Corp.**

General Electric Co. has shipped the largest mine hoist motor in the country to the **Anaconda Copper Mining Co.** at Butte, Mont. The 600-v. d.c. motor, rated 3,000 hp. at 60 rpm., will be used in hoisting ore at the Kelley Shaft, part of Anaconda's $20 million "Greater Butte Project" (See E&MJ, July, 1949).

In March, **Joy Manufacturing Co.** announced receipt of an initial order in excess of $1,000,000 for equipment to be used in the mechanization of iron ore mines in France.

Hewitt-Robbins Inc. has shipped 9,000 ft. of conveyor belt and 7 boxes of vulcanizing equipment to South America for handling iron ore from El Pao, Venezuela.

Gates Rubber Co. of Denver, Colo., recently completed a large addition to their plant for the rubber covering of chutes, bins, conveyor screws, tanks, pipe, steel plates and mining machinery.

Federal Electric Products Co. has announced the location of its fifth factory in Los Angeles, Calif.

One of the largest rolls of belting ever shipped was recently delivered by **B. F. Goodrich Co.** to an operation in southeastern United States. The 1,179-ft. belt weighed more than 14 tons. Roll diameter was over 10 ft.

General Electric Co. Launches "More Power to America" Tour

More than 2,000 different electric products, processes, and techniques are displayed in General Electric Co.'s "More Power to America" special train which is being launched on a nationwide tour. The 10-car train, hauled by a 4,500-hp. diesel-electric locomotive, will visit approximately 150 of the country's key industrial centers during 1950 and 1951. The purpose of the train is to enlarge the market for electric equipment and to disseminate engineering "know-how" to help American industry. The exhibits are designed exclusively to interest those who produce electric power, and those who put it to work. Hence the exhibit is not open to the general public.

The exhibits have been grouped in 11 different sections: power generation, distribution and transmission; drives and controls; materials handling; welding; heating; renewal parts and service shops; industrial lighting; components of industry; measurements; national security; and civic improvement. The advantages of electrification in terms of increased production, reduced costs, and improved quality are emphasized in virtually all exhibits.

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A LAUGHLIN EXCLUSIVE THAT PAYS OFF DOUBLE!

A success from the very start, the Laughlin Clevis Grab Hook has proved so popular that users in many fields have asked us: "Why not a slip hook with the same clevis advantages?" We agreed and it's available for the first time.

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Nevada *(Continued)*

The new contract also clarifies grievance, promotion and seniority procedures.

★Large scale developments of perlite deposits near Lovelock in Pershing County are planned by the **C. T. Hansen Co.**, of San Francisco. The firm has purchased 1 sq. mi. of perlite ground northwest of Lovelock and plans erection of a 100-ton treatment and handling plant.

★**Southwest Dredging Co.** is reported to be handling about 3,000 cu. yd. of gravel daily at its Spring Valley placers in the Rochester mining district of Pershing County. Owned by the A. E. Wilson estate, the Spring Valley placers were extensively prospected and developed a few years ago by Bailey, Evans & O'Mar, who hold the major royalty interest on the property. Two wells supply warm artesian water for the dredge and washing plant, permitting year-around operations.

★**Nevada Diversified Industries Corp.**, which was organized last August, is reported to have made a payment toward gaining control of 1,920 acres of high grade pumice situated in Crater Basin in Nye County. A road has been built to the property, which is reported to be one of the largest accessible deposits of top-grade pumice in the U. S.

★Work has resumed with a 20-man payroll at the **Austin-Jumbo Mines, Inc.**, property in Humboldt County, following a closedown during the winter months. C. E. Bartlett is engineer in charge. The Austin-Jumbo is an open-pit operation on gold property in the Awakening district 40 mi. northwest of Winnemucca. The mill which handles 500 tons of ore daily. The corporation was formed last November.

★Thirteen patented mining claims in the National district of Humboldt County have been purchased by a group of Grass Valley, Calif., residents. The properties were sold for delinquent taxes. New owners include Frank B. Gliko, Mrs. Ann Hampton, Claude E. Jury, and James E. Thompson.

★The new plant of the **Round Mountain Gold Dredging Co.** in Nye County is described by A. E. Bernard, Nevada state mine inspector, as "one of the neatest I have ever seen." He said the plant will be in operation early in April.

★Extensive development work is being planned at the Revesbeck mine in Churchill County, according to Albert Silver, manager of the property. Shaft sinking is progressing at the mine, and will continue to the 600-ft. level.

★**Summit King Mines**, situated 25 mi. east of Fallon in Churchill County, is milling silver-gold ore at the rate

of about 50 tons daily. The company is reported to have increased ore reserves in recent months by extensive development work conducted from the 700-ft. main shaft.

★During the second week of March, Ornelas and Holloday, who hold leases on the Tonopah-Belmont property in Nye County, shipped 20 tons of exceptionally rich ore to McGill by truck. Others making shipments from the same area were Tony Perchetti and the three Eason brothers.

★Fire completely destroyed the assay office of the Newmont Mining Co. at the Florence Mine in Nye County in mid-March. The mill, 200 ft. north of the assay office, was saved. The assay building and contents were covered by insurance and will be rebuilt at once. Mine and mill operations were not seriously affected by the fire, which is said to have started from the furnace.

★**Calumet & Hecla Copper Co.** and **American Smelting and Refining Co.** are expected to pool resources to carry out new drilling north of Tonopah this summer. A deal was closed for a block of ten claims. The property adjoins Tonopah Development holdings.

★A. E. Bernard, Nevada Inspector of Mines, said that **Combined Metals** plans also to install electrolytic operations at Henderson. If the project goes through, he added, the output of the Pioche area should be increased to double its present capacity due to the fact that oxide ores will be mined as well as sulphides. "Employment," he said, "should increase materially, perhaps to almost double that of the present."

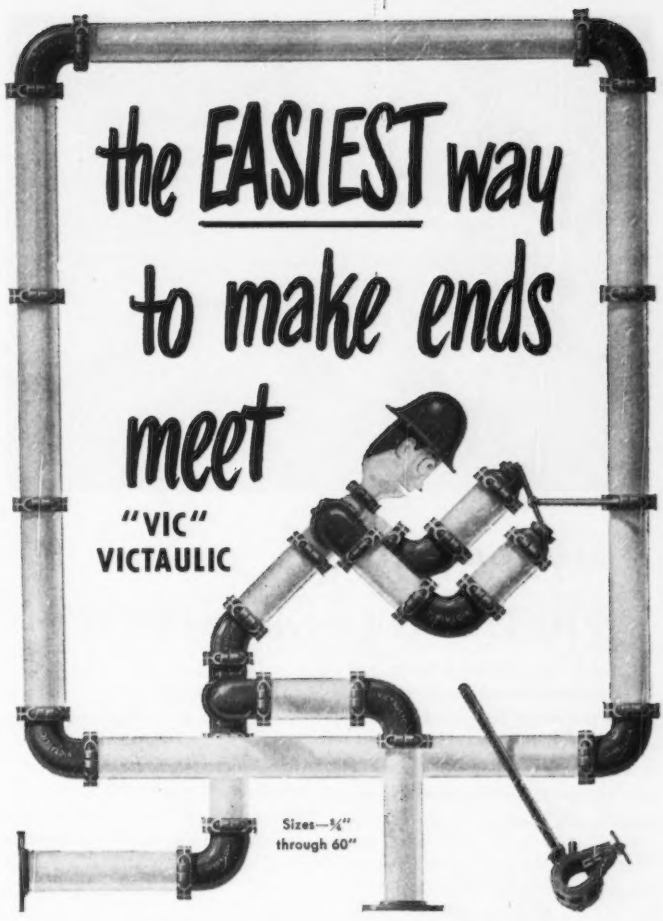
NEW MEXICO

★**The Hornet mine,** 7 mi. southwest of Hachita in Grant County, is consistently producing 50 tons daily of lead-zinc ores with a fair showing of silver. The ores are concentrated in a flotation mill at the mine.

★**Hurlow Mining & Milling Co.,** Bingham, is reported planning a 200-ton mill to work 10 claims in the Hansonburg district containing barite-fluorspar-lead ores.

★Felix Mingas and his two sons are developing a fluorspar property 5 mi. east of Glenwood. They are trucking about 45 tons of ore per week to the General Chemical mill at Deming.

★U. S. Bureau of Mines is continuing to diamond drill on the old Torpedo mine property near Organ. J. H. Brown, a lease holder, has completed a 100-ft. shaft on the **Memphis mine,** opening up two veins of high-grade silver ore. Work also has started on the Stephenson-Bennett group, where dumps will be bulldozed, screened and jigged. The dumps are more than 100 years old. In the area the Geiger



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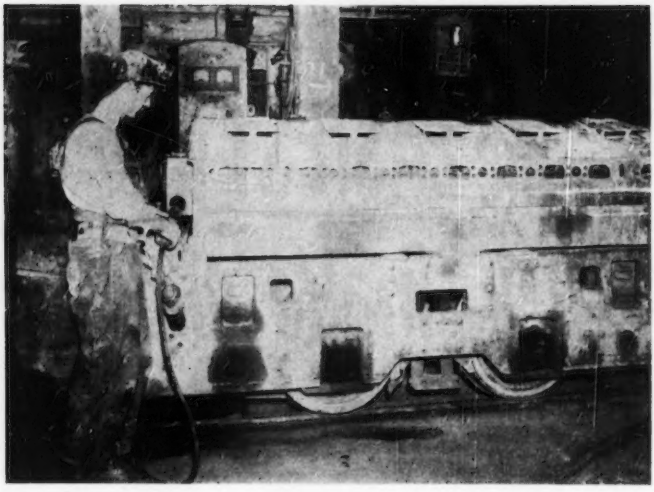

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STORAGE BATTERIES

New Mexico *(Continued)*

counter has shown considerable activity, but no reports on the source of the radiation have been made as yet.

★A bill passed by the New Mexico state legislature in 1949 amending the law on severance taxes has been declared void by District Judge Edwin L. Swope. The section exempted natural resource producers from the tax up to $200,000 annual production.

★**Duval Texas Sulphur Co.**, authorized by SEC to increase its capital stock from 550,000 shares of no par value to 1,000,000 shares and to change its name to the **Duval Sulphur & Potash Co.**, is proceeding with plans to sink shafts and build operating facilities in the Carlsbad district. It is estimated the plant will cost $7,500,000 and have a capacity of 720,000 tons.

★Construction began in January on a research pilot plant building at the **Potash Company of America**, Carlsbad.

OREGON

★Four dredges in eastern Oregon accounted for practically all the gold produced in the state in 1949; The bucket line dredge of **Baker Dredging Co.**, operating in Sumpter Valley; **Buffalo Dredging Co.'s** bucket dredge at Mount Vernon; **Porter and Co.** with a bucket line dredge on Clear Creek; and the **Calhoun & Howell** dragline dredge on the North Fork of John Day River.

There was some production at the Buffalo lode mine in Grant County. The Champion and Helena mines in Lane County shipped concentrates to Tacoma.

★A dust eliminator is being installed at **Pacific Portland Cement's** Gold Hill plant.

★**Dant & Russell**, while continuing production of Dantore, light weight aggregate, has finished installation of a $1,000,000 accoustical tile plant at the Lady Frances mine on the Deschutes River. Dantore is the only perlite plaster sand produced in the Northwest.

TRI-STATE

★**Federal Mining & Smelting Co.** has bought and taken over the Missouri holdings of George W. Potter. Included in the property transferred is the Snapp mine, north of Orongo, an 80-acre lease with a 50-ton mill; a 280-acre lease about 3 mi. from Joplin with the 75-ton Jasper mill; the North Side mill, 50-ton capacity, and well developed tracts around Chitwood; and mineral rights on the 3,400-acre Wildwood tract, southwest of Joplin, where the Mattes mine is located.

Potter, who was the largest independent mine operator, stated that his reason for selling was to put the properties in the hands of a company large enough to develop them properly. He has retained the Ritz and Lucky Bill mines at Cardin, Oklahoma.

★In an interview with a Picher, Oklahoma, official, it was learned that the **Eagle-Picher Co.** estimate of the cost of filling the cave-in at the Netta mine, is well over $100,000. This was said to be more than the threatened buildings of the Picher business district are worth.

★Defeat of the O'Mahoney Bill in Congress has been a great disappointment to the mining men of the Tri-State. J. H. Buchanan, president of Nellie B. Mining Co., and representative of the **Zinc and Lead Producers Association,** in Washington recently addressed the membership. He stated,

"We have lost a battle but we definitely have not lost the war. We will continue to work out something to aid the industry. That also is the attitude of the western mining industry. The idea will be to cooperate with them on any plan that will help the mining industry as a whole."

Meanwhile, some of the smaller mines that had been holding on, pending the outcome of subsidy legislation, would close down and quit. It seemed that there would be no general shutdown of the larger mines.

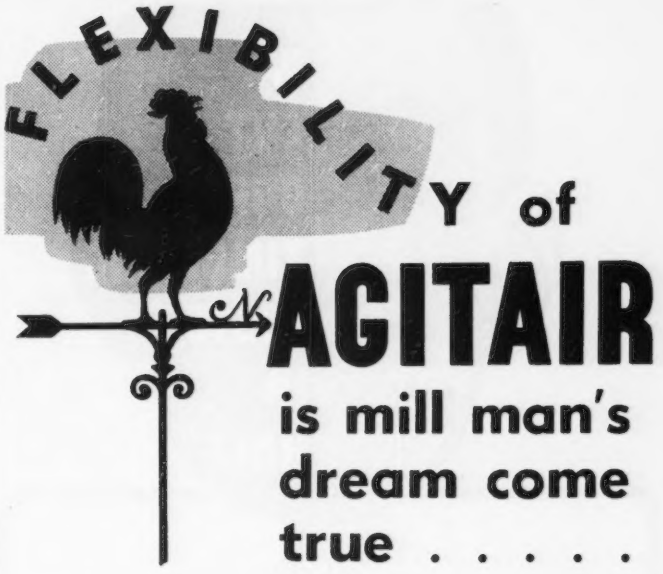
★Price of zinc concentrates has reached a new high of $65 per ton on the open market. This raises the prices paid for concentrates at the Eagle-Picher mill to $67.50 per ton.

★Employment in the district has decreased from 5,700 men in the mines when the Premium Price Plan went out of effect, June 30, 1947, to a mere 2,000 in the middle of March, 1950. The work week for 30% of the employees has been reduced to five days. Wages in some cases have dropped as much as $5.00 per day.

Three union contracts are presently in effect, each with a different parent union. In one instance, wages will increase 6.43c. per hour for each one-cent increase in the price of zinc metal above 10½c. per lb. Another contract specifies an increase of one cent per hour for each one-dollar increase in the district open price of zinc concentrates above $65.00 per ton. The third contract has no floor. Wages increase or decrease one cent per hour for each one-dollar change in the price of zinc concentrates up or down.

UTAH

★With the Utah Mining Association serving as spokesman, operators of small mines in the state have reported to the Senate Finance Committee that attempts of the govern-



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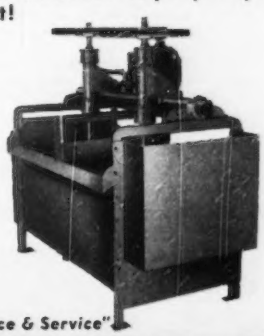

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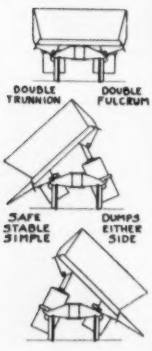

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Utah *(Continued)*

ment to classify "block lessees" as employees rather than independent businessmen "will seriously jeopardize the national production of fissionable material." The new classification is embodied in HR 600, a resolution before the House of Representatives which Utah mine operators hope can be most successfully fought in the Senate committee.

It was pointed out that the proposed law could hamstring production of uranium-bearing carnotite ore on the Utah-Colorado plateau.

★The most hopeful note of the mine-industry month in Utah came with an announcement by the **Howe Sound Mining Co.** that it plans construction of a large cobalt refinery in the Salt Lake City region on land located just north of the **American Smelting & Refining Co.'s** Garfield refinery. Cobalt would come from Howe Sound's Blackbird mine at Salmon, Idaho, where mills and concentrators are scheduled for completion in September of this year.

Howe Sound's Blackbird cobalt deposits are said to be the largest in the nation, with reserves of 1,740,000 tons and blocked reserves sufficient for at least 10 years of operation.

★Under a recent U. S. Bureau of Mines reorganization, S. R. Zimmerly, chief of the metallurgical branch, Salt Lake division, has been given the title of chief, metallurgical branch, Region IV.

★R. H. Dalrymple, Utah State Industrial Commissioner, has reported that the safety record in the state's metal mining industry for 1949 was markedly improved over the 1948 fatality tally. Six workers were killed in mine accidents in 1949 as against 17 deaths in 1948. The record low mark was registered in 1947 with four deaths.

The **Kennecott** open-pit operation at Bingham, largest in Utah, was cited for its low accident rate of 7.8 per 1,000,000 man-hours worked as against 12.7 for 70 open-cut mines and quarries in the nation.

★The U. S. Atomic Energy Commission has established a small purchase depot at Marysvale, Utah, for the purchase and stockpiling of ores recently discovered and developed in the region. The purchasing depot is to be operated for the Commission by **American Smelting & Refining Co.**, which already operates an AEC buying station at Monticello, Utah.

WASHINGTON

★A 100-ton mill and flotation plant is planned this summer for the **Kromona Mines Corp.** property, north of Sultan, according to J. F. Krom, president. Work will resume this spring on a 5-mile mine-to-market

road. Values at the property are in copper, gold and silver.

★Kaiser officials report that production and profits at the Trentwood and Mead aluminum plants will be the best yet for the spring quarter.

★**Silver Mountain Mining Co.** will pay $50,000 in royalties and from earnings on stock held by Edward Rowan, president and manager and by R. C. Mulligan, secretary-treasurer, for the Silver Star lode claims between Tonasket and Loomis. According to George Jamme, mining engineer, there are four vein outcrops, one being traced for 3,500 ft. Development to date consists of a 1,400 ft. crosscut with a 400 ft. raise to the surface for ventilation.

★U. S. Bureau of Mines production figures gives the state 1,200 tons of zinc and 900 tons of lead for January.

★**Lindquist Pumice and Concrete Block** plant at Brewster is installing a larger machine to produce 3,000 8x8x16-in. pumice blocks daily.

★A new discovery at the **Bonanza Lead** mine, north of Colville, has induced the management to replace the present 100-ton mill with a 500-ton sink-float and flotation plant. Concentrates from the new find are said to be running 75.5% lead and 12.4 oz. silver per ton. The new haulage crosscut on the sixth level, nearing completion, will speed up extraction of the ore.

★According to **American Smelting & Refining Co.'s** annual report, the 100-ton daily capacity sulphuric acid plant at Tacoma, is expected to be completed in April.

★**Eagle Mountain Mining Co.**, organized last year to revive the United Copper mine near Chewelah, will open three adjoining mines through the 4,000-ft. United Copper tunnel. Deepest development is 1,500 ft. An estimated 300,000 tons of ore has been blocked out, according to Conrad Wolfe, president. He said that a mill and compressor will be installed as soon as possible and that a $16,000 power line will be built to the property when finances permit. Values are in copper, silver and gold.

★**Washington Brick & Lime Co.'s** new $300,000 continuous operation tunnel kiln, scheduled for completion April 15, is the first plant in the area to use butane gas as an industrial fuel.

★**Reeves-MacDonald** mine produced 1,100 tons of zinc concentrates and 217 tons of lead concentrates in February. Output should be doubled by July when the mine is expected to be in full swing. Jens Jensen, secretary, said operation costs are less than half those at Pend Oreille.

★At a recent luncheon in Spokane, Evan Just, E&MJ editor, addressed members of the **Northwest Mining Association** and of the Mining and Industrial Bureaus of the Chamber of Commerce, on the necessity of improving the tax situation for the mining industry.

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IN CANADA

• Nickel Reserves Reach All-Time High
• Three New Orebodies at Noranda

CANADA

★There was encouragement for mining in Finance Minister Abbott's budget speech this year, with the announcement that profits made by prospectors on mining properties would be exempt from income taxes by an amendment to the Income Tax Act. "It is not (our) policy," said Mr. Abbott, "to tax capital gains." Tax exemption will also be extended to the end of 1953 on expenditures by producing companies in exploration for oil and minerals.

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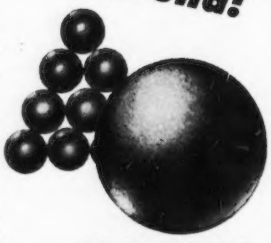

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ONTARIO

★Ore reserves of **International Nickel Company of Canada** reached a new all-time high of 251 million tons at the end of 1949, an amount sufficient to last the company until 2,000 A.D. at the 1949 rate of production. Sales last year were down from 1948, and net profits declined from $2.55 per share to $2.08.

Inco has a big expansion program underway at its Sudbury area properties, with two new shafts being sunk and two others deepened. Plant expansion includes a new 6,000-ton concentrator and a new "oxygen flash" smelter. The company's operating mines have more than 266 miles of underground workings.

★**Dome Mines** increased ore reserves at its veteran Porcupine mine last year to a level well above the average for the past seven years, but net profits were down from 83¼c. to 76c. per share. Ore reserves stood at 2.5 million tons. At the same time Dome's outside interests continue to expand. **Campbell Red Lake Mines,** in which Dome holds 58% control plus advances of $2,350,000, has been brought into profitable production, and has recently also acquired the adjoining property of **Dexter Red Lake Gold Mines.** (Dexter shareholders get one Campbell share for 10 Dexter, plus about 17.5c. cash.) **Sigma Mines,** Dome's main subsidiary, had an excellent year (See Quebec news). New this year is Dome's 25% interest in **Dome Exploration (Western) Ltd.,** formed with capital of more than $10 million to acquire Alberta oil properties.

★Heavy new development work has been started at another Porcupine gold producer, **Pamour Porcupine Mines.** The main shaft is being deepened 1,000 ft. from its former bottom at 2,200 ft., while the West-end shaft will later be deepened by raising from the new levels to be established from the main opening. The program will take several years to complete.

★An all-time earnings peak was reached in 1949 by **Aunor Mines,** with net profits of 21.2c. per share compared with 20.7c in 1948. Tonnage milled was about the same as in 1948, but recovery increased from $11.36 to $12.96 per ton. The mine has about four years' ore in sight, and is in the midst of a depth exploration program in which the main shaft is being deepened from 2,125 to 3,100 ft.

Good ore was found a year ago on Aunor's 2,500-ft. horizon by lateral work and drilling done from the adjoining Delnite mine and the new Aunor depth program, which won't be completed until some time in 1952, was planned with that foreknowledge.

★Encouraging new ore possibilities are reported by **Preston East Dome Mines.** Development last year resulted in a general broadening of the ore potential in the upper levels, the an-

nual report discloses, while new ore found in the greenstones was also important.

Ore reserves have reached their highest point since 1945, while net profits of 10.6c. compared with 8.4c. in 1948. More than 50% of all drifting during the year was in ore.

★Little encouragement was had last year at depth by **Hallnor Mines.** The annual report showed net profits up from 29.9c. in 1948 to 33.2c., and ore reserves raised almost 25% to 501,000 tons. But most of this ore is above the seventh level. Exploration work on the new 18th and 19th levels was "not as encouraging as had been expected."

★**Hollinger Consolidated Gold Mines,** with more than 38% of all ore mined coming from above the 800-ft. level, had another good year in 1949, though profits were down slightly at 36.9c. per share. Ore reserves at year-end stood at 6.4 million tons for the company's two mines, a decline having been registered every year since 1945, when they stood at 7.5 million tons.

Exploration interest is at the main Porcupine mine, where the No. 25 internal shaft is being deepened to 5,750 ft. Present mine bottom is at 5,150 ft.

★The first dividend in many years to come from a silver mine in the old Cobalt camp has been paid by **Silver Miller Mines,** which made its first payment, 5c., in April. It came just six months after the start of production.

★**McKenzie Red Lake Gold Mines** earned 5.9c. per share last year in its most profitable year since 1943, thanks to improved grade and lower costs. A dividend of 3c. was paid, first since 1944, yet working capital at the end of the year was up more than $100,000.

★**MacLeod-Cockshutt Gold Mines** is continuing development of its new "F" ore zone, where drifting has been giving good results on the 11th level. Originally found on the 10th, where a length of 1,513 ft. averaged $5.25 across 50 ft., the new zone will soon be under exploration on the ninth level as well.

QUEBEC

★With the big job of removing clay from the workings just about completed, **Consolidated Beattie Mines** is now planning to sink a winze from the ninth level at its Duparquet twp. mine to open four levels. The clay removal job, made necessary by slides that occurred in 1943, 1944 and 1946, has cost between five and six million dollars.

Beattie's production this year has been running about 30% ahead of last year, the mill averaging close to 1,800 tons daily with recovery 0.122 oz.

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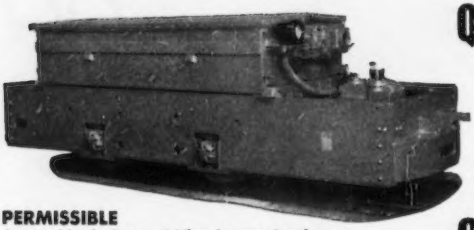

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Quebec *(Continued)*

per ton. One of the marginal mines to which the Emergency Gold Mining Assistance Act has been most beneficial, Beattie is now making good profits on monthly production of around $240,000. Should cost-aid disappear at the end of this year as scheduled, however, the mine's future will depend on its ability to produce a higher grade of millfeed.

★**Noranda Mines** broke many records in 1949, with net profits of $5.68 per share, metal sales of $19.1 million, and income of $2.45 per share from interest and dividends. Output of gold, copper, silver and pyrite from the company's own Horne mine was substantially higher than in 1948, while volume of customs business reached a new peak. One of the features of the annual report was the disclosure of three new orebodies, two gold and one copper-gold, aggregating 3.3 million tons. These are the first major ore additions reported at the Horne in many years.

★Another feature of Noranda's report was the addition of 7,000,000 tons of copper ore to the reserves of **Gaspe Copper Mines**, Noranda's subsidiary on the Gaspe peninsula, close to the south shore of the St. Lawrence River. Total reserves stand at 48 million tons averaging somewhat better than 1% copper. Decision as to underground work will probably be made this year.

★In 1949 **Sigma Mines** (Quebec) was another mine to have its best year since the war. New profits at 59.4c. per share were the best since 1942 at the Bourlamaque township mine, while ore reserves, despite a new record of 416,970 tons milled, reached the highest level in the company's history at 1.4 million tons.

★Possibilities of developing a gold orebody are seen in the results of surface drilling at **East Sullivan Mines**, in Bourlamaque township. Located 2,500 ft. east of the mine, the new ore indications are found in a strong shear zone, considered to have important potentialities. Meanwhile the mine, main product of which is copper, continues milling at 2,500 tons daily.

★**Waite Amulet Mines** earned $1.56 in 1949, compared with $1.90 in 1948, and dividends were reduced from $1.50 per share to $1.40. Ore reserves at year-end were 1.1 million tons, down from 1.4 million tons a year earlier. Increased development work is in progress, including a new 1,200-ft. shaft to develop additional ore discovered in deep surface drilling, and three winzes in the "A" and "C" areas.

★Impressive widths of new ore have been developed in recent months by **Canadian Malartic Gold Mines** at its Malartic property. Discovered first in a new graywacke area south

of the shaft on the fourth level, the ore has an indicated volume of 1,900 tons per vertical foot averaging $4.85 per ton, slightly above average.

BRITISH COLUMBIA

★A $100,000 development program will be started soon on the Wellington mine, a Slocan property idle since 1946. The program will be financed by **Waddington Mining Corp., Ltd.**, Vancouver, which will receive a 51% interest. Remaining 49% will be retained by **Wellington Mines, Ltd.**

★**Silver Tip Gold Mines, Ltd.**, upper Salmon River area, reports development largely confined to one vein which promises good tonnage of shipping ore. W. R. Tooth, manager at Stewart, states the width is 5 ft., with 1.5 to 2 ft. being high-grade and the balance good milling ore.

★Installation of a 50-ton daily capacity milling plant has been decided upon by directors for **Highland-Bell, Ltd.** property on Wallace Mountain near Beaverdell. The decision to mill the ore on the property is based on estimated savings on freight and smelter charges plus an additional profit on zinc content.

★A mill of 30-ton-a-day capacity is being installed this spring at the property of **Doreen Mines, Ltd.**, near Terrace. Construction of a small hydroelectric plant has been started. Formerly known as the Boulder group, the Doreen property is on Knauss Creek.

★**Van Roi Mines (1947) Ltd.**, near Silverton, has terminated its agreement with **Kenville Gold Mines, Ltd.**, for treatment of ore at the Kenville concentrator.

★An entirely new orebody with an indicated average grade of 13% zinc has been disclosed by development work on the 10th level of the Zincton unit of **Sheep Creek Gold Mines, Ltd.**

★Customs ore shipments to **Consolidated Mining & Smelting Co.'s** Trail plant in the 4-week period ending March 18 totaled 15,299 tons, including 7,194 tons of lead and 8,105 tons of zinc, compared with a total of 6,975 tons in the previous 4-week period including 3,062 tons of lead ore and 3,913 tons zinc.

★**Spud Valley Gold Mines, Ltd.**, has approved a major capital reorganization to reopen its Zeballos, Vancouver Island, mine.

★**Silbak-Premier Mines, Ltd.**, which resumed its Portland Canal operations last November after a 16-month shutdown resulting from a labor dispute, reports a net operating loss for the 7 weeks' operation up to the first of this year of $54,927.

No new orebodies have been found, but some known bodies have been extended. Broken and unbroken reserves at the end of 1949 were 61,966 tons

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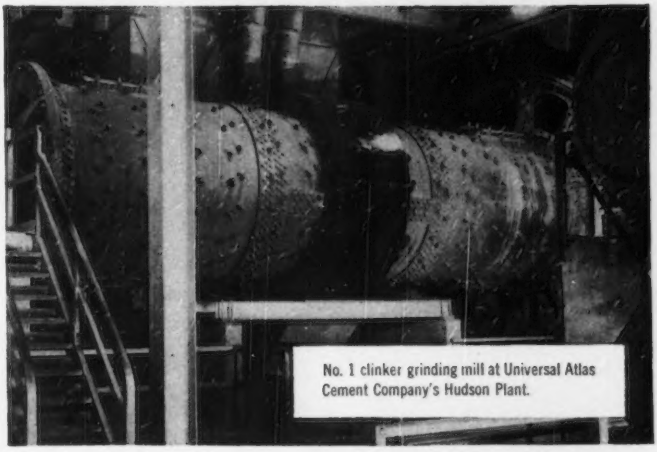

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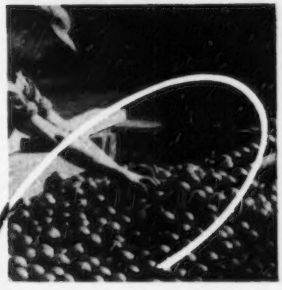

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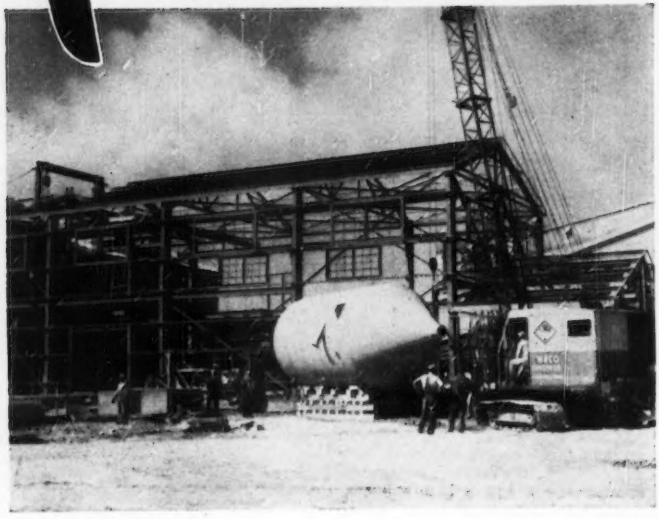

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British Columbia *(Continued)*

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★Increasing development is in store for **Bralorne Gold Mine,** Bridge River, this year, as officials push shaft sinking programs and plans for further investigation of the new "85" vein, discovered 55 ft. below the 25th level during sinking of the Empire shaft.

★Output from **Island Mountain** mine for February is reported at 1,461.68 fine oz. gold from 3,531 tons of ore milled, valued at $56,187.

★High-grade ore is being encountered by **Santiago Mines, Ltd.,** on the east and west faces of the new 8th level at the company's Bosun mine near New Denver in the Slocan district.

★Additional mechanized equipment will speed the new low level exploration tunnel this season at the **Golden Contact Mines, Ltd.,** property at McGillivray Falls. Malcolm MacGregor, managing director, says addition of a two-machine "Jumbo" driller, with the mucking machine already at the property, should make possible driving about 20 ft. of tunnel per day.

★A group of placer operators headed by Leverett Davis, mining engineer, Portland, Ore., has purchased a 1-cu. yd. dragline dredge from **Inland Mining Co.** of Quesnel. The new owners plan to move the machinery and equipment to placer leases on Nation River in the Omineca district.

★**Violamac Mines (B. C.), Ltd.,** near Sandon, plans to build a small mill within the next year. Last year's production gave a net profit of $146,790 when an average of six tons a day was handled.

★**Hedley Mascot Gold Mines, Ltd.,** is prepared to proceed with placing Sunloch-Gabbo Copper mine, south Vancouver Island, on production providing a partner willing to invest $600,000 can be obtained.

★**Base Metals Mining Corp.** reports an operating loss of $23,079 for the two-month period of December and January for its Kicking Horse and Monarch mines at Field. Decrease in tonnage milled was due to severe weather conditions, and to lower grade of ore.

★At the Cork Province property in the Slocan area, severe weather conditions also retarded development and delayed the start of deepening the shaft below the 5th level.

NORTHWEST TERRITORIES

★**Giant Yellowknife Gold Mines, Ltd.,** reports gross recovery of $272,491 in February from 10,951 tons of ore averaging 0.713 oz. gold. The average

milling rate for the month was 291 tons. During the month No. 3 shaft was deepened to 464 ft. below the shaft collar elevation.

YUKON

★Operations on Big Gold and Glacier Creeks, tributaries of the 60-Mile River, Yukon, will be on a much larger scale this year, C. F. Herbert, manager of **Yukon Placer Mining Co.**, of Seattle, stated. The company planned to start work late in April with a crew of 22 men, using a 4-cu. ft. bucketline dredge. In placer operations from the middle of last July until the end of the 1949 season, the Seattle company recovered gold valued at $150,000 from leased ground owned by Yukon Explorations, Ltd., subsidiary of Transcontinental Resources, Ltd. A bulldozer was used to mine ground formerly stripped by Yukon Explorations.

MANITOBA

★**The Howe Sound Co.**, in its annual report for 1949 refers to the operations of the **Howe Sound Exploration Co., Ltd.**, at Snow Lake, Manitoba, stating that progress has been made in solving the metallurgical problems which created difficulties at the start of operations in June. Gold extraction in December was considerably improved. Grade of ore produced from the mine equaled expected values and before the end of the year full capacity of 2,000 tons was reached.

★**Nor-Acme** earnings through royalties from the Snow Lake property, leased to Howe Sound, are increasing each month. December royalties were four times greater than those of last June.

★**San Antonio Gold Mines, Ltd.**, reports a net profit for the year 1949 of $354,696, or 14.8c. per share, a slight increase over 1948. The company milled 185,735 tons for a recovery of $10.14 per ton, compared with 154,953 tons at $11.32 for 1948. Operating costs were reported at $6.43 per ton of ore treated compared with $6.35 per ton for the previous year. Ore reserves were maintained at 720,000 tons of which 160,000 were broken.

★**Jeep Gold Mine, Ltd.**, subsidiary of San Antonio, had a net loss of $22,841 for the year ended Dec. 31, 1949. Gross production was $152,715 from treatment of 6,291 tons of ore for an average recovery of $25.86. Average costs for the year totalled $26.23.

★**Hudson Bay Mining and Smelting Co., Ltd.**, reports net income for the year ended Dec. 31, 1949, was $12,714,840, equivalent to $4.61 a share on the outstanding common stock. This compares with a net income of $15,443,137 or $5.60 a common share

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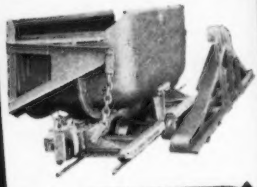

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Manitoba *(Continued)*

for 1948. Gross income for 1949 was $37,431,182 compared with $39,038,493 in 1948.

★**Lee Gordon Mines, Ltd.**, reports that diamond drilling on the Vamp Lake property will be discontinued pending a geological survey of the ground. Recent diamond drilling indicated a sulphide zone over 200 ft. in length, comparatively narrow widths and low values were encountered.

★**Sherritt Gordon Mines** has optioned claims at Cranberry Portage, on Lake Athapapuskow, covering discoveries of copper and gold. Geophysical work is being carried out and it is presumed diamond drilling will follow.

Diamond drilling has been stopped on Sherritt Gordon's Oxford Lake group of claims. Only barren sulphides were found in the anomalies explored.

IN LATIN AMERICA

- Mexico Faces Strikes
- Chuqui Strike Ended
- Progress at Cerro Bolivar

MEXICO

★With labor contracts coming up for renewal at most of Mexico's mining properties, the industry is passing through another attack of the creeping paralysis that has plagued Mexican mining for years. Fresnillo was shut down by strike on March 6, with the union demanding a 30% wage increase, the company offering 10%. Although a few new contracts were signed, a wave of strikes seemed inevitable in the industry generally. Eventually these strikes would be settled, no doubt at a wage increase level around 12 to 18%, but in the meantime the industry, the men, and the country would be the worse for the recurrent unrest.

★Felix Ramirez, secretary of the miners' union, called recently for nationalization of the mining industry. He used terms worthy of John Lewis in describing the "insulting opulence of the mine operators" in contrast to the "incredible misery" of the Mexican workman. The Mexican Chamber of Mines called his plea for nationalization "a grave error." The Chamber cited the sad results of such nationalization of industry in England.

★The confused state of the world was emphasized recently in a statement of the Mexican Chamber of Mines deploring the drop in the price of lead in the United States. Pressure of lead from Mexico on United States' markets was itself largely responsible for the decline in price. Furthermore, the Chamber expressed worry that lead from Europe might be offered on the world's markets, thereby injuring Mexico's income from lead still more deeply. There is, indeed, little likelihood of Mexico's selling much lead in Europe, because it is reported that exportable surpluses of lead exist in Germany, Yugoslavia, and France. All these countries look to the United States as a market for lead, both because of their surpluses and because of their desire to earn dollars.

★Ore production in Mexico's mines is dropping at a rate of about 100,000 tons per year, says the Chamber of Mines. Total shipments of ore to treatment plants ran about 1,200,000 tons in 1947, 1,100,000 tons in 1948, and 1,000,000 tons in 1949. Rising costs, largely the result of devaluation, are cited as the reason.

PERU

★Through a decree issued by the Peruvian government on November 11, 1949, the par value of the currency was abolished, and the sol entered a free market. This decision was taken on the advice of a commission headed by Mr. Julius Klein and including several other prominent U. S. economists. This group considered the former official rate of 6.50 soles to the dollar as fictitious, and that price controls and the requirement that exporters sell part of their foreign exchange to the government at the 6.50 rate was injuring the Peruvian economy. Exporters will now hand in all their foreign currency to the government bank, which will issue certificates of import. These can be negotiated by them in the free market. Exchange value of the *sol* will depend on supply and demand. The government will buy all the foreign exchange it needs from the Bank at the average quotation given by commercial banks.

★**First effect** of this measure was a rise of the sol. Formerly quoted unofficially at 18.00 to the dollar, the sol had risen by mid-January to 14.00. Prices of foodstuffs were declining.

★Banco Minero has finished a thorough survey of all the mines in **Huaro-**

chiri district, about 100 miles inland from Lima. These mines, notably the Germania and the Chanape, have been worked for many years. Lack of access roads and milling plants has held the district to a small tonnage of hand-sorted ore. Chanape mine, alone, is said to show about 60,000 tons of ore carrying 25 oz. of silver, some gold, and 8% lead. The Banco is planning to build a road about 20 miles long to connect the district with the Central Highway at San Mateo. A mill for the district is also planned.

★Prospectors are going over a **manganese deposit** near Macusani in the Department of Puno. The deposit consists of veins in limestone, and is said to be quite high grade. The nearest railroad is 60 miles away, but 8 miles of highway would give access to trucks.

VENEZUELA

★Maj. Gen. Max Clayton Tyler, U. S. Army Corps of Engineers (ret.) left late in March for Venezuela to investigate the possibilities for developing a water route to get iron ore from **Orinoco Mining Co's Cerro Bolivar deposit** to the coast. General Tyler is an expert on river and harbor work. He is best known for his flood control work along the Mississippi, when his headquarters were at Vicksburg.

Comd. George G. Lancaster, USNR, in also in Venezuela to study the alternative of rail transport of this ore. Comd. Lancaster is the former assistant engineer in charge of construction for the Chesapeake & Ohio Railroad.

Harmon Lewis, former president of the Alcoa Steamship Co., is in Venezuela to lay plans for shipment of ore to the United States. Frank Burnette, assistant to M. W. Reed, U. S. **Steel's** vice president in charge of engineering, will handle the engineering phases of this transportation-study mission. Leslie F. Young, formerly head of industrial relations for Socony-Vacuum in Colombia, has gone to Venezuela in a similar capacity for Orinoco Mining Co. This U. S. Steel subsidiary is now carrying on an aerial mapping campaign over the several routes to the coast for its iron ore. Fairchild Aerial Surveys is doing the job in conjunction with the men just mentioned.

Mack C. Lake, president of **Orinoco Mining Co.**, told a press conference recently that there are 500,000,000 tons of proven iron ore reserves in the Cerro Bolivar deposits. He thought ultimate reserves might amount to as much as 1,500,000,000 tons. He said the company hoped to begin exporting a minimum of 10,000,000 tons a year within the next four years.

★The **Venezuelan Development Corporation** has authorized **Salem Engineering Corporation**, a U. S. firm, to make a six months' study of the possibility of establishing a steel industry in Venezuela, based solely on Venezuelan raw materials.

★**Siderurgica Venezolana**, which makes reinforcing rods from scrap iron, complains that it may be forced out of business if Belgian and West German firms are allowed to continue shipping their products into Venezuela at low prices. Company officials say their price of Bs 450 per metric ton compares favorably with prices offered by Mexican, Brazilian, and Chilean importers, but is considerably higher than prices offered by importers of the Belgian and German products.

★Reports of rich diamond discoveries in Bolivar State, near the junction of the Caroni and the Urinam rivers, touched off a rush to the area recently. About 3,000 would-be miners have gone to the region despite the long canoe trip up the Caroni. The Government has sent a special mission to the area.

★The Government has appointed a three-man arbitration board to help find a solution to the strike of 1,500 workers against the **Iron Mines Company of Venezuela**, subsidiary of **Bethlehem Steel Co.** The strike began on Feb. 6 when the company rejected demands for higher wages and increased social benefits. The arbitration board is composed of a representative of the company, the union, and the Government. The Venezuelan labor minister, Dr. Rojas Contreras, declared the strike legal, and also compared wages and working conditions in the iron ore operation unfavorably with those prevailing in the oil fields.

CHILE

★A recent strike of drill crews and shovel operators at the Chuquicamata copper mine was settled early in April, when the Government got the men to go back to work pending a settlement of their wage demands. At almost the same time, Sr. Gonzalez Videla, president of Chile, was due in Washington on an official visit. There was no doubt that one of the chief topics in his talks with United State's officials would be the price of copper, the continued suspension of the duty on imported copper, and the treatment of American companies which are mining copper in Chile.

★The Chilean Bureau of Mines has been investigating the apatite orebodies of the Provinces of Atacama and Coquimbo.

★**Callejas Brothers**, who operate gold mines and mills at Capote Aurifero and at Petorca, have bought the copper mine and mill of Farellon Sanchez at Matancilla, Coquimbo Province. This 100-ton mill has been idle for 10 years, and will need reconditioning plus a new power plant.

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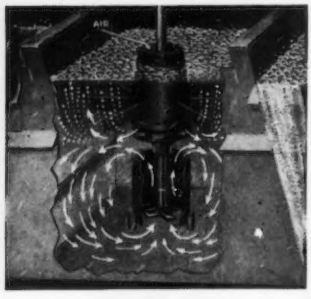

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IN THE PHILIPPINES

• Gold Income High
• Lepanto's Good Record

★Gross value of the production of the principal Philippine gold mines in January were $870,500 at $35 gold. **Benguet-Balatoc** led the list with $403,000 from milling 55,000 tons averaging $7.30 per ton. **Mindanao Mother Lode, Atok,** and **Surigao Consolidated** followed in that order. **Lepanto Consolidated,** a copper-gold producer, recovered $267,900 from milling 16,913 tons in the month.

★Because gold was sold in the open market in Manila in January at $53 per oz. or higher, the actual income to the mines was about 30% higher than the statutory price, even after allowing for the 25% of output that has to go to the Central Bank for $35. The surprising strength of the Manila free market, in contrast with the sag in the Chinese and French markets, has drawn much attention. Fears over peso devaluation and inability to get dollars have held the gold price up thus far in Manila. It looked shaky, however, in March.

★**Lepanto Consolidated** made excellent progress in 1949, as revealed in its annual report. Ore reserves at the end of the year totaled 2,073,540 tons averaging 4.26% copper and 0.316 oz. gold per ton. This was an increase of 440,740 tons over reserves a year earlier, in spite of 184,367 tons sent to the mill during the year. The gross value of the ore reserves, based on 18½c. copper and $35 gold at the year end, exceeded $42,420,000.

Lepanto had 11 stopes in active operation as 1950 opened, with a stock of 50,000 tons of broken ore. Labor duty for ore breakage in the stopes averaged 6.8 tons per man shift, with a marked increase in general labor efficiency resulting from an incentive bonus plan.

The mill produced 25,924 tons of concentrates during the year averaging 28.8% copper and 0.96 oz. gold per ton. Copper recovery was 92.2%; gold, 75.7%. No material change was made in the flow sheet, but a somewhat lower-grade concentrate was produced to permit a larger gold recovery with the pyrite.

Capacity of the mill is being expanded to handle 1,000 tons per day. New construction is progressing well and completion is expected by summer. Expansion plans will not interfere with current milling rate of 500 tons daily.

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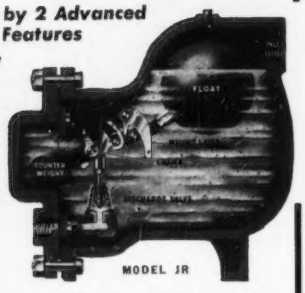

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tion, depletion and taxes were $10.15 per ton in 1949. Mining cost was $2.53, milling $1.70, marketing $4.19, general overhead $1.73. Labor conditions were uniformly good.

★**Atok-Big Wedge Mining Co.** was unable to maintain its ore reserve position intact in 1949. Exploration and development work failed to replenish ore mined during the year. Reserves of positive and probable ore declined to 271,300 tons at the end of 1949, from 365,880 tons a year earlier. Average grade of ore reserves slipped to $11.35 per ton, contrasted with $13.30 in 1948.

During the year 148,137 tons was milled averaging $16.12 per ton with a gold recovery of 93.9%. Operating costs of $9.25 before depreciation, depletion and taxes were higher than in 1948, due to an expanded development program and a 20% pay increase to night shift men. Net profit for the year was $1,152,700.

★**Surigao Consolidated** reported ore reserves of positive and probable ore in excess of 300,000 tons at the year-end, averaging $13 per ton. One shaft has been completed to the 500-ft. level and crosscuts are being driven to the orebody. The company declared an initial postwar dividend of ½c. per share in March.

★**Consolidated Mines** resumed shipments of chromite ore to U. S. in January after suspension of operations in the last quarter of 1949 because of lack of orders. It is expected that 34,000 tons valued at $340,000 will be shipped in the first quarter of 1950. Construction of buildings, bins and foundations for the Heavy Media plant were nearly completed in January with the machinery and equipment yet to arrive. The washing plant took 17,400 tons of ore in January and returned 5,328 tons of lump ore to the bins, a ratio of 3.3:31. In 1949 the mine produced and shipped 165,340 tons of ore at an overall cost of $6.54 per ton before charges. Net profit before income tax was $593,000.

IN AUSTRALIA

• Devaluation Hasn't Helped
• Rich Ore on Tennant Creek
• Tungsten Prospects Good

Australia produced 893,262 fine ounces of gold in 1949, compared with 890,805 oz. in 1948 and 937,654 oz. in 1947. A survey of month-by-month production figures for the last few years, released by the Commonwealth statistician, does not even indicate that the slight upswing in 1949 was due to the higher gold price resulting from the slump in the pound-dollar exchange in the latter part of the year. On the contrary, less gold was produced in the second half of 1949 than in the first half, although in 1939 and in 1944-48 more gold was produced in the second half than in the first half of each year.

The number of persons employed in the gold-mining industry of Australia, including prospectors and fossickers, was 10,731 in 1948, the latest year for which figures are available. With the exception of 1943-45, this was the lowest figure on record in recent years.

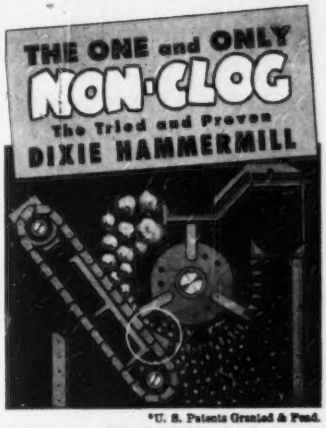
The official study also reveals that Australia imported 72,821 oz. of gold from the Territory of New Guinea, 327 oz. from Papua and 29,821 oz. from New Zealand in 1948-49 while exports totaled only 395 oz.

NORTHERN TERRITORY

★Developments during the past 12 months have proved exceptionally high values in driving and crosscutting on the 135-ft. horizon and the results so far from the No. 1 pilot winze have "eclipsed anything previously encountered on the Tennant Creek field," according to a report on **Doria Gold Mines N.L.** by C. E. Blackett, consulting engineer. After allowing for operating costs, advance development and other items of capital expenditure, net profit of the mine should exceed £200,000 a year and this would be further enhanced if a cyanide leaching plant was brought into operation, according to the report. The report substantiated earlier estimates of ore reserves, which placed them at 93,475 tons. There is believed to be sufficient proved ore to keep the mill in operation for at least four years on an average of 2 oz. per ton. The company has acquired the Joan of Arc lease adjoining one of its Noble's Nob properties. Development of the lease has been recommended by Mr. McKeown, well-known consulting engineer.

WESTERN AUSTRALIA

★**Great Boulder Pty. Gold Mines, Ltd.,** continues to earn considerably increased revenue through devaluation, but physical output remains stationary in spite of the price incentive. Latest yield for three months was



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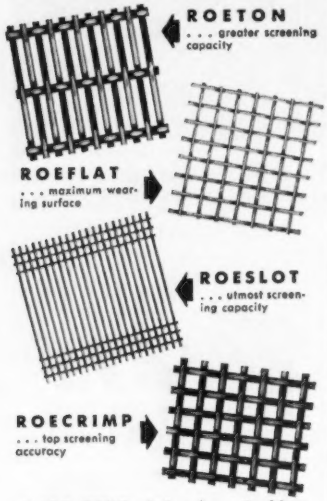

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A CENTURY OF CONFIDENCE

Australia *(Continued)*

worth £301,587 while income for the preceding three-month period was also over £300,000, compared with £200,000 a quarter before devaluation.

★**Central Norseman Gold Corp.** has taken an option over The Mount, a property close to the railway line near Widgiemooltha, 56 mi. from Norseman. If the option is exercised after underground prospecting, it is proposed to transport the ore to Norseman for treatment. The company has acquired milling equipment which, when installed, will lift the Central Norseman plant's capacity to 200,000 tons a year, from the present 130,000 tons a year.

★**Linden (W.A.) Gold N.L.** has accepted a free working option for 12 months over the Queen of the May mine at Yundamindera in the Murchison gold field. The mine has not been in operation since 1917, but was recently dewatered by a Kalgoorlie syndicate. Samples broken from below the 130 ft. level averaged over 3 oz. per ton over an average width of 15 in. Linden Gold intends to equip this shaft and sink it a further 50 ft.

★**New Coolgardie Gold Mines N.L.** has purchased from **Western Mining Corp.** the Callion property, 70 mi. north of Coolgardie. Prospecting undertaken by Western Mining before the war disclosed a long flat orebody. Ore reserves are estimated at 63,000 tons averaging 10 dwt. per ton. With the Barbara shaft now in full operation, New Coolgardie directors expect the mill to reach a through-put rate of 40,000 tons of oxidized ore a year within the next few months. Addition of hard ore could step this up to 60,000 tons.

★**Ora Banda Amalgamated Mines** is planning to reorganize the company and to purchase new treatment plant, to bring the Grant's Patch property again into production. The mine's treatment plant was destroyed by fire in 1947.

★The Wiluna Mine, under option to **Mt. Charlotte Gold Mines, Ltd.,** has spent a large amount on surface equipment and underground mining in opening up the 300 and 500-ft. levels. This development work has disclosed the existence of extensive bodies of low-grade ore. C. S. Beale, Mt. Charlotte's chairman, believes that after driving and crosscutting at the 500-ft. level this orebody may promise to become an important gold producer at the north end of the Kalgoorlie field.

TASMANIA

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they produce. This point is made by Dr. J. A. Dunn, Government mineral economist, in a Bureau of Mineral Resources release on the copper situation. Any considerable downward revision of the copper price would place Mt. Lyell, the largest Australian producer, in a serious position. The other three Australian producers—**Mt. Morgan, Mt. Isa** and **Cobar**—would be able to hedge on the tax-exempt and stable-priced gold constituent of their ores. However, Dr. Dunn foresees no spectacular price moves during the next 10 years outside the range of £100 to 120 stg. per ton. He estimates Australian production at 17,000 tons in 1950-51, at 35,000 tons in 1952-56 and at 44,000 tons a year from 1957. Consumption over the same period is estimated to increase to 60,000 tons, to leave a deficiency of 16,000 tons a year.

★**Zeehan Mines, Ltd.**, has been registered with a capital of £100,000 by **North Broken Hill, Ltd.**, and **Broken Hill South, Ltd.**, to continue investigations in the Zeehan silver-lead field. Depending on the outcome of these investigations, Zeehan Mines may become an operating company later. It is hoped that information will become available soon as to whether the Spray mine could be reopened.

★Lack of coke caused by sporadic coal strikes in New South Wales has again closed **Mt. Lyell's** smelting plant at Queenstown. To ease the shortage, the company has purchased 2,000 tons of South African coke.

★Mill recovery rate of **King Island Scheelite (1947), Ltd.**, should be even better this year than in 1949, it is predicted by the company's chairman, Wallace H. Smith. A selling contract for U. S. account was recently signed. Current production is running ahead of prospectus estimates. A vanner plant is being installed to improve recoveries to 75% sale-grade scheelite, against the 1949 average of 59%. Mill alterations are expected to step up through-put to 200,000 tons a year, compared with 160,000 tons in 1949. In the year ended last October King Island sold 862 tons of scheelite concentrates, 337 tons more than in the preceding year.

NEW GUINEA

★**Bulolo Gold Dredging, Ltd., Placer Development, Ltd.**, subsidiary, despite having dredge No. 5 out of commission since No. 22, reported higher production for the quarter ending Feb. 28 than in the corresponding period last year. From 3,022,000 cu. yd., recovery was 15,387 oz. fine gold valued at $538,545 or 17.82c. per yd. Output for the preceding quarter was $666,400 and for the corresponding quarter of last year $498,890. In the nine months ended Feb. 28, Bulolo produced gold worth $1,968,654 against $1,828,225 in the same period of the previous year. Salvaging of the capsized dredge No. 5 is proceeding satisfactorily, but it will be some weeks before it is known when it will be in operation again. European employers in the field have been granted an increase in wages of one pound weekly with an increase in the weekly cost of living bonus for married employees of 17s. 6d. During wage negotiations, dredges were down two days in February and March.

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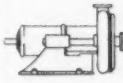
NAGLE Centrifugal Pumps handle flotation froth and heavily laden, abrasive liquids. Mixtures with moisture content so low they will just barely flow are readily moved by Nagles.
The pump shown is a 10" Type "SW-OX" Frame 238X Pump used in certain facilities at Oak Ridge National Laboratory . . . one of many types of vertical and horizontal pumps for metal mining, ore preparation and refining.
This unit has neither submerged bearing nor stuffing box. The outlet is at the bottom to make it completely self-draining.
Send for Catalog 4906.



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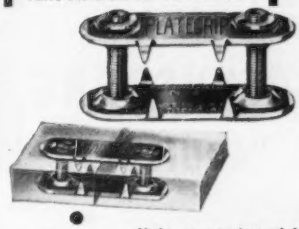
IN EUROPE

- Italian Sulphur Goes To Australia
- Uranium Found in Sardinia

ITALY

★A new mining law in Sicily provides for Government assistance to discover the resources of the subsoil. There is reason to believe that petroleum, potash salts, etc., exist on the island in addition to the traditional sulphur and rock salt.

PLATEGRIP
PLATE FASTENERS FOR CONVEYOR BELTS



Make strong dust-tight, water-tight joints in belts of any width. Special design spreads tension uniformly across belt, allow natural troughing of belt and assures smooth operation over flat, crowned or take-up pulleys. Sizes for belts of from 1/4" to 1 1/2" thickness. *Write for Catalog Sheet.*

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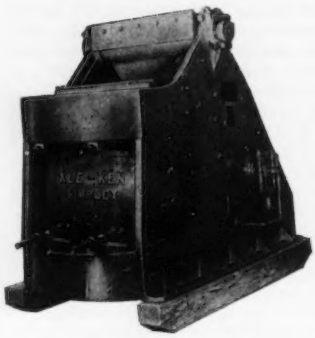

Model shown is #90 36" x 20"

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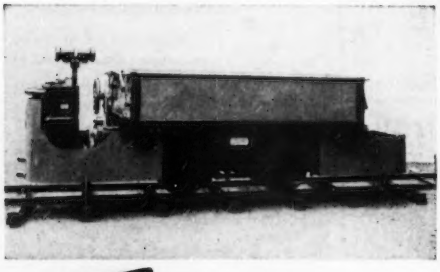

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Italy *(Continued)*

The law assigns this exploration to the "Assessorato" for industry and commerce. In the first stage, the nature, conformation and possible ore extent will be studied to decide what explorations to subsidize and also to direct private enterprise into the best risks. The actual development will be left to private enterprise assisted by Government grants.

Perhaps the most important work will be that done on the metallic ores found in the Peloritan Mountains. Although there has been some study of this area, information is still insufficient.

★**Italian Sulphur Corp.** has made the first shipment to Australian and New Zealand importers under a contract calling for delivery before July 31, 1950, of 150,000 tons of sulphur worth $7,000,000 (4,500,000,000 lire). This sulphur will be supplied almost exclusively by Sicilian mines and will do much to relieve depression in this field.

Last year a total of 82,900 tons of raw and refined sulphur valued at 2,400,000,000 lire was exported, so the present transaction represents an increase of 170% in volume and 180% in value over 1948 sulphur exports.

★Output from the Gargano bauxite mines under a speed-up program should amount to 220,000 tons in 1952-53, 46% above the 1948 level. The cost of necessary installations and equipment has been estimated at $400,000, and $60,000 will be spent for imported machinery.

The loss of Istria where the largest Italian bauxite mines were located has caused Italy to concentrate on developing the Gargano beds where work was begun in 1939. Although increased output of aluminum, amounting to 50,000 tons annually, is planned, the necessary supplies of bauxite should be almost covered by the increased production.

★**Montecatini Co.** has applied for permission to prospect for uranium in the Sasrabus district of Sardinia, and the Cogne Co. has applied for a similar permit for an unstated locality on the Island. Other groups are also working on uranium prospecting. Visits by the ambassadors of the United States, Great Britain and France to the island were noted in the Italian and foreign press in connection with the rumor that uranium had been discovered on Sardinia.

★Recent explorations in the Val Malenco region, from Monte Disgrazia to Pizzo Scalino, have found important veins of calcite containing large crystals of ilmenite, according to the Sondrio correspondent of the financial daily *Il Sole*. A fragment of this crystal examined by Professor Grill of the University of Milan weighed nearly ½ kg. The size and richness of the bed is said to allow industrial working.

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Connellsville Bottom Discharge Skips speed up the hoisting process, requiring less travel for dumping, and aid in accelerating the unbalanced loaded Skip. Toggle-locked chute prevents skip from discharging its contents while in transit—no spillage.

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SERVING THE MINING INDUSTRY SINCE 1901

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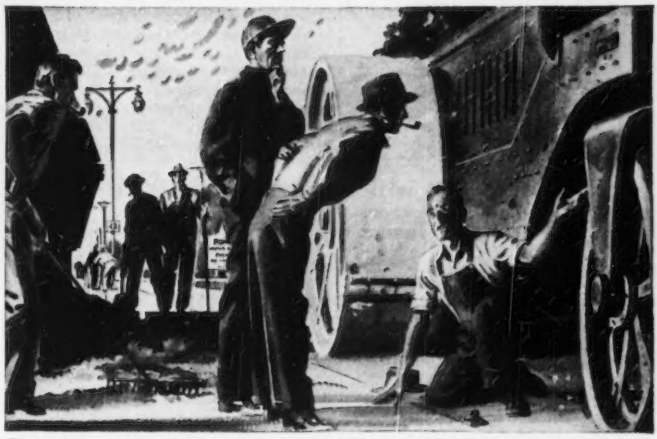

Time clause in housing project paving contract stood good chance of being invoked when equipment broke down at 5 P.M. So 10-lb. carton of replacement parts was Air Expressed from 1200 miles away. Delivered in just 8 hours. The Air Express charge was only $3.84—and contractor completed job on time.

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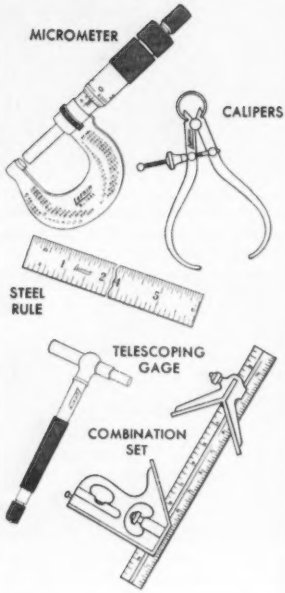

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SWEDEN

★**Boliden Mining Company** has taken over mines producing fluorite and lead in the Osterlen district of southern Sweden. Fluorite output is more than enough to cover the company's needs, and lead production should be increased by improved methods. Diamond drilling is being undertaken at several places. Although Boliden prospecting practically covers the country, this is the first acquisition outside the Skelleftea field. Annual Swedish production of fluorite is around 3,000 tons.

★**The high government bid** for German-owned mines in Sweden indicates, in the industry view, that the present Socialist majority was bent on acquiring the mines regardless of profitability. A bid made by a group of steelworks was much lower, and furthermore this group intended to hold the largest mine, at Haksberg, as a future ore reserve. The government is planning to operate it, despite big losses suffered by previous owners.

Haksberg ore only contains 32-35% Fe, but there are something like 30 million tons of usable ore. The mine's proximity to various steelworks is favorable, however. But so long as better ores are available, Haksberg ore is not much in demand in Sweden. The mines were in German ownership just prior to each World War, when prices were of secondary importance, it is pointed out in mining circles.

The Strassa mine, bought by the Swedish Grängesberg company from Austrian owners after World War I, is still not being operated. Yet it is regarded as the most valuable reserve of phosphorus-free iron ore in the country. It is certainly more profitable to operate than the mines now bought by the government. There is certainly one field with 40% Fe, and 10% Mn, but impurities make it difficult to exploit commercially.

The general impression is that the government was determined to get into the mine operating field, from which it has so **far** been conspicuously absent, except in shale oil production. The government share in the Luossuvaara-Kiirunavaara company, from which the bulk of Sweden's ore exports stem, is purely financial. Operation is in private hands.

FRANCE

★A preliminary study of the aluminum industry in Western Europe recently completed by the Non-Ferrous Metals Committee of the Organization for European Economic Cooperation indicates that the Marshall Nations have been **over-optimistic** in their estimates of future consumption of **primary aluminum.**

The report states that consumption of primary aluminum in the countries participating in the ERP, although

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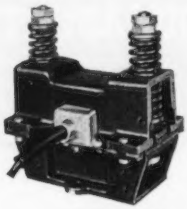

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assessed at 374,000 metric tons in 1949 against 367,000 tons in 1948, probably hasn't topped the 1948 figure.

Estimates submitted by individual countries show that consumption may reach 564,000 tons of primary metal in 1952-53 and 681,000 tons in 1955. But the Committee thought that in fact consumption probably wouldn't exceed 508,000 tons in 1952-53. It also felt the 1955 estimate was over optimistic although it was too early to guess the likely short-fall.

Production of primary aluminum in the participating countries reached 216,000 tons in 1949 against 201,000 tons in 1948. According to individual estimates submitted it may climb to 381,000 tons in 1952-53 and 462,000 tons in 1955. There also are production possibilities in the Dependent Overseas Territories which may materialize by 1955, although no final decision has been taken yet on these projects. The above estimates of future production include certain major projects contemplated by individual countries, for expanding plant or accompanying hydroelectric capacity.

★The Committee attempted to **measure manufacturing capacity** in the participating countries. This is hard to do precisely since certain plants may be used for more than one metal, and capacity varies according to the amount of material to be transformed and the technical problems involved. However, the Committee estimated present manufacturing capacity of the participating countries at 920,000 tons, of which 700,000 are for drawn, extruded, and rolled products, and 220,000 tons for castings and forgings.

New capacity the participating countries propose to create by 1955 adds up to 192,000 tons for drawn, extruded, and rolled products, and 8,500 tons for castings and forgings. Much of this new capacity, though, will replace existing obsolete capacity.

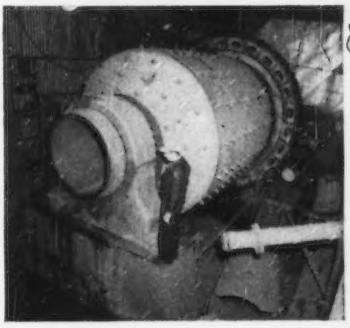
IN AFRICA

- **Good Lease Terms for Kennecott**
- **Nickel Property Under Development**

★Devaluation and the use of small-scale mining methods have helped to reopen two closed gold mines on the Rand. These are Van Ryn and Van Ryn Estates. **New Kleinfontein Gold Mines, Ltd.**, has bought Van Ryn, and a syndicate called **New Van Ryn (1950), Ltd.**, has taken over Van Ryn Estates for £40,000. The latter plans

"Abrasion grinding? . . . easy!

. . . with a HARDINGE Convex-Head Mill."



The feed to this Hardinge 10′ x 12′ Convex-Head Cylindrical mill is 150 tons per hour of classifier product. The mill discharge goes to secondary classifiers. Results: Substantial reduction in silica with an average input of 4 H.P. per ton.

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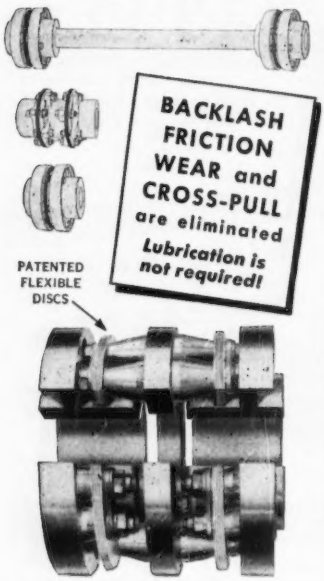

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Africa *(Continued)*

to operate the mine at a milling rate of 4,500 tons monthly, against the former through-put of 60,000 tons a month.

★Working costs reached a new high in February on the Rand. The mark was 29s. ld. per ton, an increase of 10 d. over January. This is well over last year's average cost of 27s. per ton. Both grade of ore and revenue, on the average, were increased in February. Average grade was 3.799 dwt. against January's 3.761 dwt. Revenue rose 5d. to 47s. 4d. per ton. Gold output totaled 916,702 oz. for the month, against January's 979,588 oz.

★Favorable lease terms have been granted in the Orange Free State to holders of a new mining lease in which **Kennecott Copper Corp.** has a substantial interest. The **Kennecott-Anglo-Transvaal Exploration Co.**, formed in 1948, plans to develop mines in the Free State through its operating subsidiary, **Virginia Orange Free State Gold Mining Co.** Kennecott has guaranteed £2,562,500 toward working capital, of which £562,500 was to be subscribed for in shares at par and £2,000,000 in 15-year debentures.

The lease formula, established by the Union Minister of Mines, will allow the new company to benefit from the higher price of gold on a scale comparable with mining leases granted before devaluation. Special arrangements have been made to see to it that Kennecott Copper will be repaid in dollars, out of earnings, to the same extent to which it subscribed. Interest will accrue to Kennecott in dollars at the same exchange rate at which its dollars were originally converted to pounds.

★**Industrial Diamonds of South Africa, Ltd.**, reports that high production of diamonds is forcing control measures on the industry in order to maintain the price of industrial diamonds.

★Work has resumed on what seems to be a nickel-copper-platinum mineralized region quite similar to the Sudbury district in Canada. This is the Insizwa mine at Mount Ayliff in East Griqualand. The principal minerals in the orebodies are like those at Sudbury and appear to have crystallized in the same order.

There is a massive pyrrhotite containing up to 3% copper, 5% nickel, and 4 dwt. platinoids. Another variety of ore carries around 16% copper, 5% nickel, platinoids up to 27 dwt. and gold from 0.2 to 5.0 dwt. The management considers this to be the greatest nickel deposit in the sterling area.

Insizwa has been worked before, but in a perfunctory way that overlooked the possibilities of the orebodies. The present operator, **Nickel Corporation of Africa, Ltd.**, is pushing exploration with all possible speed.

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We call our new core drill the "Teredo" because it will out-bore any other machine of its size. This light, compact, portable core drill will recover cores up to 2¼" in diameter and operate at depths to 600'. It can be mounted on drag skids, jeep, truck or trailer; and powered by air motor, electric motor, gasoline or diesel engine or truck take-off. It's simple, rugged and relatively inexpensive.
Either mechanical screw feed or hydraulic feed can be furnished. Send for Bulletin 30-EM.

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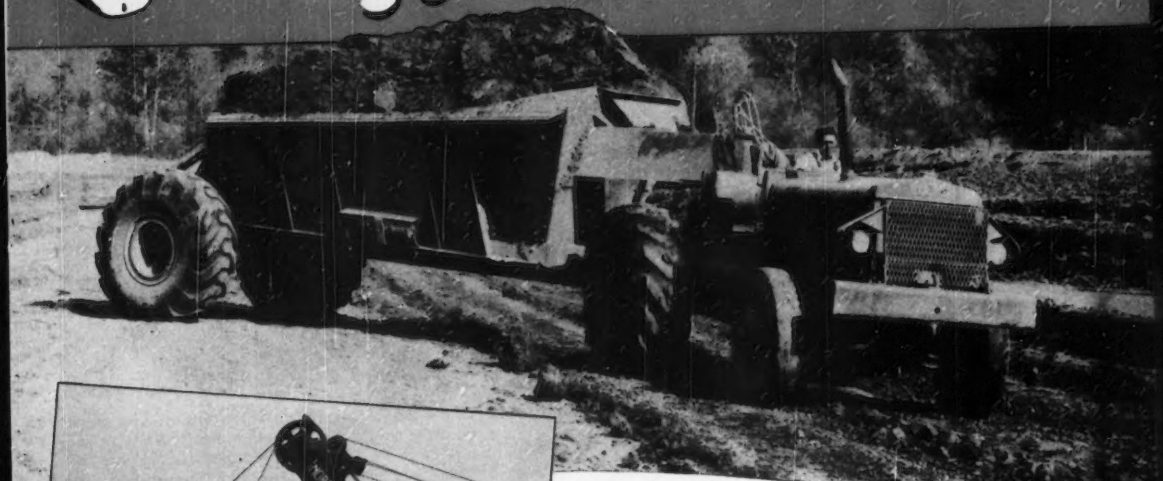

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POWER—125 to 380 h.p. diesel engines
SPEEDS—Up to 35.7 m.p.h. loaded

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★ Men who know hauling equipment prefer Euclids. On mining and construction jobs the world over, you'll hear owners say, "Euclid is the best hauling equipment we've ever used". Operators, too, like "Eucs" because they have plenty of power and are easy to handle.

Euclids have earned their reputation for rugged staying power, low cost production and continuous operation on hundreds of tough jobs. From bumper to bumper every part is designed and constructed for long life in heavy duty off-the-highway hauling. The ability of Euclids to "keep coming back for more" is the reason why owners agree that Euclids really do the job.

The recommendations of a hauling equipment specialist are available without obligation—call or write your Euclid distributor.

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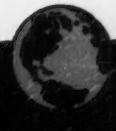
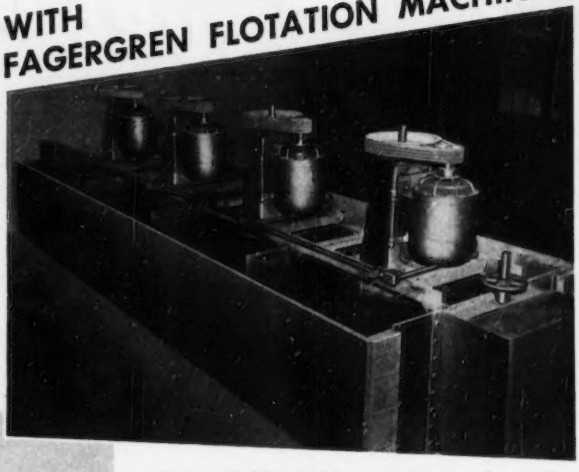
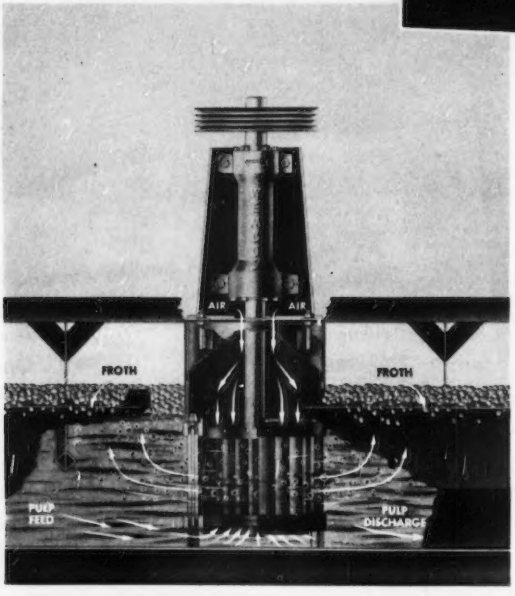


REAGENT COSTS REDUCED 45% WITH FAGERGREN FLOTATION MACHINES!



This new Fagergren Flotation Machine paid for itself in 8 months from reagent savings alone.



One 4-cell, 56" x 56" Fagergren was used to replace an older type 6-cell machine in this 350-ton per day operation. Improved aeration dropped reagent costs from 12.7¢ per ton to 7.0¢ per ton. Total monthly saving was over $500. In addition, this new installation has substantially reduced power consumption and maintenance expense.

LOW REAGENT CONSUMPTION is a direct result of the thorough dispersion of air achieved by Fagergren's rotor-stator design. The superiority of rotor-stator aeration, together with the basic ruggedness of these elements themselves, increases mill operating profits in many important respects:

- High mineral recovery
- Minimum reagent consumption
- Low power consumption
- High capacity per cubic foot of cell volume
- Minimum maintenance expense
- No shutdown time

THE NEW FAGERGREN CATALOG is just off the press. The operating principles of the machine are clearly illustrated and described. Mechanical construction is shown in detailed cross-sectional drawings. Capacities, dimensional data, horsepower requirements, shipping weights and other essential information on all sizes are given in convenient tabular form. Send for your copy today.

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WKE (HMS) Mobil-Mill • Coal Spiral • Standard Thickeners (HMS) Thickeners • (HMS) Media Pumps • Hydroseparators (HMS) Densifiers • (HMS) Separatory Cones • "SH" Classifiers Sand Pumps • Conditioners and Agitators • Fagergren Flotation Machines • Dewatering Spirals • (HMS) Laboratory Units

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● The expression "Built Like A Mack Truck" was not coined by us. It worked its way into America's everyday language because for 50 years Mack trucks have been an accepted symbol in the public mind for something extra strong and extra rugged.

To truck users in excavating and quarry work, in pit and strip mining, in oil field hauling — "Built Like A Mack Truck" means even more. It means trucks that are built to build profits... designed to give advantages offered by no other make. Powerful Thermodyne and diesel engines! Massive heat-treated frames! Rubber Shock Insulators! Hydraulic Power Steering! Air Assist Clutch! Mack's matchless Balanced Bogie and Power Divider.

All are Mack advantages that assure power and brawn for the heaviest loads... easy handling for fast loading and unloading... flotation and traction for the most slippery mud or sand.

Find out what "Built Like A Mack Truck" can mean on your particular job — in greater profits through greater output... greater economy.

Be Profit-Wise

Modernize with

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Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.

"...AND DRIVING OVER THIS GARNET IS A TOUGH TEST FOR ANY TIRE"

"We're mining garnet here and it's tough stuff. Garnet is used as an abrasive, so you can guess what it does to tires. And our trucks are driving over it all day. We've found these U. S. Royal Con-trak-tors can take it all the way."

U. S. ROYAL CON-TRAK-TOR. Just look at all the *extras* built right into this rugged tire:

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U. S. FLEET SERVICE. Your U. S. Royal Distributor is ready to draw up a tailor-made preventive tire maintenance plan designed especially for your operation—a plan which can give you lower cost per tire mile! He'll give you service where it counts—on your job! Call your U. S. Royal Distributor today. He's listed in your Classified Telephone Directory.

U. S. ROYALS

Products of UNITED STATES RUBBER COMPANY

Here coal is prepared in this new blending and washing plant completely designed and built by Link-Belt. From this plant the washed coal is delivered to the tunnel belt conveyor (right side of above photograph) on which it is transported to the river and rail loading station.

River and rail loading station also built by Link-Belt Company where washed coal is loaded into barges, or by means of a by-pass conveyor, into railroad cars.

World's Longest Single Belt Conveyor

Through a mountain, under forests, roads and streams this single 30" wide belt conveyor transports coal from preparation plant to river and rail loading station—10,900 ft. from foot pulley to head pulley—more than four miles of belt operated by one drive!

After careful analysis of various methods of transportation ultimate economy dictated the selection of this belt conveyor. By building this conveyor in one flight, intermediate transfers, heavy machinery and power wiring were eliminated from the tunnel.

Link-Belt Company engineered, equipped and erected the blending and washing plants, the conveyor equipment and the river and rail loading station. Resulting success of this and other similar projects illustrates the importance of such coordinated effort.

Typical cross-section through tunnel showing belt conveyor and battery driven patrol car. Standard Link-Belt type "100" idlers are used throughout the 2-mile long belt conveyor.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in Principal Cities. 11,844-A

LINK-BELT

Belt Conveyor

EQUIPMENT

IDLERS • TRIPPERS • BELTS

PULLEYS • BEARINGS • DRIVES

Now . . . buell ELECTRIC PRECIPITATOR

This announcement of the availability of a made-in-America "SF" Precipitator is NEWS of broad significance. With a Precipitator, also, Buell is in a position to provide any efficiency desired in the collection and recovery of fine and ultra-fine dusts.

The Buell "SF" Electric Precipitator is made under license from Svenska Fläktfabriken, subsidiary of ASEA (Swedish General Electric Company). Through 18 years of engineering experience and more than 150 installations in 11 countries, the broadest range of operating conditions have been met. The "SF" Precipitator now takes up equivalent first line service in the Americas:

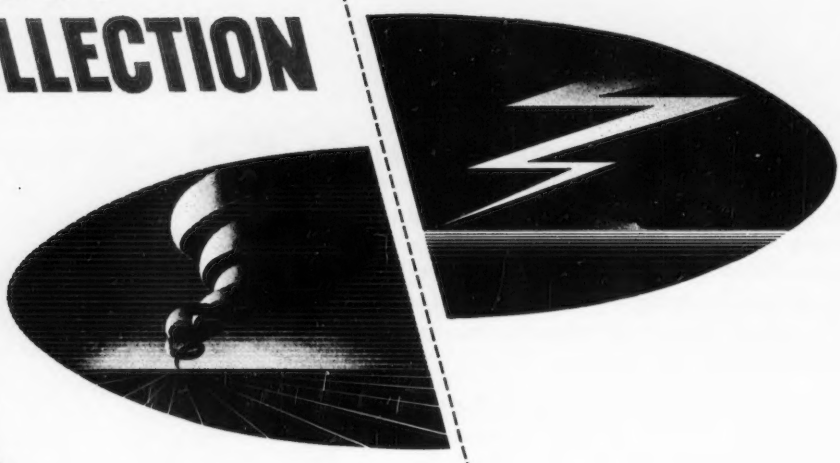
- in separating and collecting dusts of value suspended in process air or gases.
- in fly ash and nuisance dusts collection for general air pollution abatement.

Sizes and types of equipment are standardized to meet all needs.

The Buell Sales Engineering Staff invites opportunity to discuss specific problems. Write, wire or telephone.

World experience in both techniques of

DUST COLLECTION



buell van Tongeren CYCLONE

Scientific dust collection and the doing away with air pollution was just coming into its own in 1935, when Buell introduced to America the high-efficiency van Tongeren designs of AERODYNE.

The Buell van Tongeren Cyclone pioneered in lifting centrifugal dust separation onto a new high plane. How solidly its patented van Tongeren Shave-off contributed to reaching otherwise unobtainable efficiencies is evidenced in the multi-industry use of this Buell System—and 15 year records of multiple re-orders.

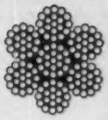
For many, many conditions the Buell van Tongeren Cyclone is bound to be first preference, with fractional efficiencies, costs, operating simplicity and long-term reliability all taken into account. Catalog on request.

buell ENGINEERING COMPANY

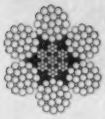
70 Pine Street, Suite 5035, New York 5, N. Y.

Whatever the job

6x7 rope is made with 7 wires in each of 6 strands around a fiber core or a steel core. It may be bright or galvanized steel, stainless steel or monel metal. Uses are for haulage, guying, sand lines, core barrel lines, rigging, controls, etc.

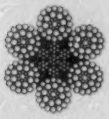


7x19 is made with 7 strands of 19 wires each, one strand forms the core. It is widely used for corrosion-resisting wire rope of galvanized steel, stainless steel and monel metal. Widely used for aircraft controls and for miscellaneous hoisting and controls.

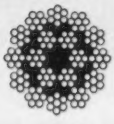


6x19 classification is made with wire combinations varying from 16 to 26 wires in each of 6 strands. Supplied *PRE*formed or non-*PRE*-formed, Lang Lay or Regular Lay, with fiber core, or steel core in bright and galvanized steel, stainless steel and monel metal. It is one of the most widely used ropes for general hoisting, cranes, excavating equipment, haulage, mining, logging and rotary drilling. Illustrated is a cross-section of 6x19 filler with I.W.R.C.

select the right wire rope for your equipment from



6x37 group has various types with wire combinations ranging from 26 to 46 wires in each of 6 strands. Supplied *PRE*formed or non-*PRE*-formed, Lang Lay or Regular Lay, with fiber core or steel core. It is extremely flexible and has many uses for hoists, ladle cranes, coal cutting machines, winches, dredges, excavating equipment, etc. Illustrated is a cross-section of 6x41 I.W.R.C.



18x7 is made as illustrated with 18 strands of 7 wires each and supplied *PRE*formed. It is a non-rotating "Kilindo" rope made by combining two opposing lays of rope. Its principal use is for hoisting with a single line to overcome rotating or spinning of the load. It is desirable for small shop and warehouse electric hoists, and for sewer, subway and mine shaft work.

8x19 is an extra flexible rope made in various wire combinations. It is used in iron and special traction grades for passenger and freight elevator service, and in Monarch Whyte Strand Improved Plow Steel for many and varied purposes where the rope is not subjected to heavy crushing loads. Illustrated is 8x19 Seale Special Traction Elevator Rope.

A thousand and one
WIRE ROPES
made by
MACWHYTE

Putting the right wire rope on your equipment puts dollars in your pocket

Perhaps you have several uses for wire rope. Perhaps there are several types of rope you could use. But for better service, lowest operating cost, you should get a specific recommendation for each job. Tell us what equipment you have, how you use it, and the size and type of rope you are now using. Take advantage of our specialized wire rope experience with all types of equipment. Get specifications for the correct rope to use on each machine you have. Just call a Macwhyte distributor or write direct to Macwhyte Company, Service Department, Kenosha, Wisconsin.

MACWHYTE WIRE ROPE

MACWHYTE COMPANY 2937 Fourteenth Avenue, Kenosha, Wisconsin Manufacturers of Monarch Whyte Strand PREformed, Internally Lubricated Wire Rope, ATLAS Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal and Stainless Steel Wire Rope. Catalog on request. Mill Depots: New York • Pittsburgh • Chicago • Minneapolis Fort Worth • Portland • Seattle • San Francisco • Los Angeles

How leading operators use

BECKMAN pH CONTROL

To boost recoveries, save man-hours, reduce processing costs per ton of ore

Throughout the mining industry—in gold, tin, tungsten, lead, zinc, copper and many other flotation operations—Beckman pH Control is proving to be the key to much higher recoveries, better control of processes, lower labor and chemical costs. *Result—substantially greater profits per ton of ore!*

THE BECKMAN MODEL H-2 pH METER is one of a complete range of Beckman pH Meters available for every type of application*. The H-2 is particularly recommended for applications where high accuracy and simple operation—combined with the convenience and low cost of 115-v. AC operation—are desired.

It provides instant and direct pH readings, and a simple, built-in dial permits quick, convenient temperature compensation over the entire range of 0° to 100°C (32° to 212° F.). High reading accuracy is assured by wide-spread dual range scale that reads from 0 to 8 pH or from 6 to 14 pH at the turn of a switch. Same switch also provides instant millivolt readings from 0 to ±800 mv and from ±600 to ±1400 mv for titrations and oxidation-reduction measurements.

Built-in electrode support and compact case design save valuable space and permit easy portability to various plant locations.

Particularly important is the wide range of factory-sealed, maintenance-free Beckman Glass Electrodes available for use with this instrument . . . electrodes that are virtually unbreakable . . . that cover extreme temperature ranges from below freezing to above boiling . . . that have an unprecedented pH range with negligible errors . . . that are abrasion-resistant and chemically durable to a degree never before thought possible in glass electrodes.

*In addition to the H-2 Meter, other Beckman pH equipment includes completely automatic pH indication and control instruments for large-scale process applications . . . battery-operated models for complete portability in plant and field use . . . and a laboratory type instrument that features maximum versatility and accuracy for research and laboratory applications

HERE ARE TYPICAL EXAMPLES:

A large Canadian mill found that by Beckman-controlling the alkalinity of the copper and zinc circuits (each at a different pH), far greater recoveries were obtained—at lower chemical costs—with better control of froth and steadier operation of circuits. This mill now uses completely automatic Beckman pH Control wherever possible.

A large Bolivian tin producer found that Beckman pH control of its complex flotation processes not only increased recovery but also simplified control of its operations and assured greater uniformity, less waste, faster treating time.

Another operator handling zinc, copper and other ores in multiple circuits found Beckman pH Control to be "one of the greatest improvements" made in his mill operations. Ore changes, even from a single mine, caused wide pH fluctuations. With Beckman equipment "such changes are now detected and corrected immediately—not sometime after the analyses are in." The resulting greater recovery and higher profits per-ton paid off the installation in a few months and continue bringing in added profits year after year.

Don't overlook the advantages of Automatic pH Control! The Beckman Model H-2 Meter above is ideal for spot checks and portable applications. For added savings be sure to investigate Beckman *completely automatic* pH recording and control. Electrodes placed in various circuits operate centralized control equipment to permit instant check on each processing step, provide a written record for subsequent analysis, and make possible many other cost-cutting advantages.

Your authorized Beckman dealer will gladly supply more data on the profitable application of Beckman pH Equipment—or write direct. *Beckman Instruments, National Technical Laboratories, South Pasadena 2?, California.* Factory Service Branches: NEW YORK • CHICAGO • LOS ANGELES.

Helpful Literature gladly sent on request!

BECKMAN INSTRUMENTS
control modern industries

Beckman Instruments: pH Meters and Electrodes — Spectrophotometers — Radioactivity Meters — Special Instruments

You'll move more ROCK for your money, over the years, with a . . . .

MARION 4161

Sixty-five years have taught us what it takes to build REAL shovels . . . how to build qualities into them that don't meet the eye but are eloquent in terms of performance and dependability.

These extra qualities are MORE than worth every penny they cost.

THE MARION 4161

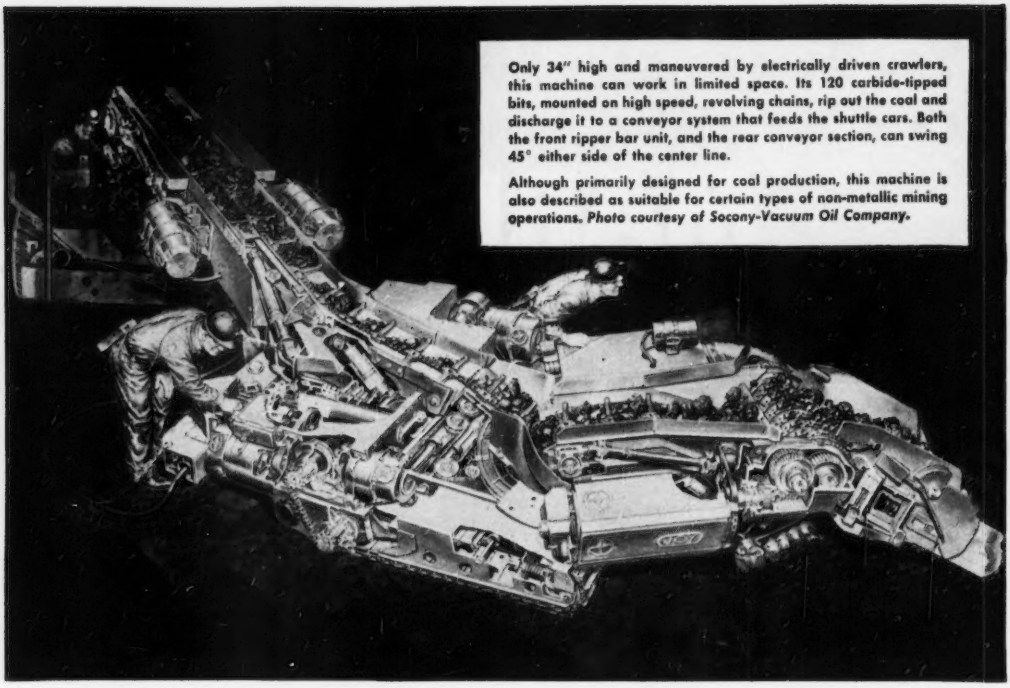
has made an impressive name over the years . . . one company owns 26 of these machines . . . and another has 25!

MARION is proud of the 4161 and its record . . . and stands behind this and every other machine that bears the MARION name.

We build good shovels and we back up every MARION owner only for one reason . . . it's the best way to give you more for your money . . . both for today and over the years.

MARION POWER SHOVEL CO.
MARION, OHIO, U. S. A.

OFFICES AND WAREHOUSES IN ALL PRINCIPAL CITIES



Only 34" high and maneuvered by electrically driven crawlers, this machine can work in limited space. Its 120 carbide-tipped bits, mounted on high speed, revolving chains, rip out the coal and discharge it to a conveyor system that feeds the shuttle cars. Both the front ripper bar unit, and the rear conveyor section, can swing 45° either side of the center line.

Although primarily designed for coal production, this machine is also described as suitable for certain types of non-metallic mining operations. *Photo courtesy of Socony-Vacuum Oil Company.*

Here's a way to mine

2 Tons of Coal Per Minute

...with the help of NICKEL ALLOY STEELS

THIS Joy Continuous Miner can rip coal from seam faces and load it into transport equipment for removal to the surface, *at a rate of two tons per minute*...

It eliminates blasting, increases safety, reduces timbering requirements and combines operations usually done by blasting, cutting, drilling and loading.

To assure long, trouble-free performance... under conditions involving severe shocks, stresses and wear ...the builder of this electrically operated machine, Joy Manufacturing Company, Franklin, Pa., specifies nickel alloy steels for some thirty vital components.

These nickel alloyed steels provide extra strength, excellent impact values and fatigue resistance, along with resistance to wear. Nickel alloy steels may help to improve the performance of your equipment. Send us details of your problems for our suggestions. Write us today.

EMBLEM OF INCO SERVICE

Over the years, International Nickel has accumulated a fund of useful information on the properties, treatment, fabrication and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes, nickel silver, cupro-nickel and other alloys containing nickel. This information is yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

BATTERY-POWERED SHUTTLE CARS ARE SAFER ALMOST 2 TO 1!

PROVED BY SURVEYS!

Yes, it's a fact! Mine-wide surveys conducted in 29 coal mines using shuttle cars showed that only half as many accidents could be attributed to battery powered as to other types of shuttle car power. A full report of these surveys—and 23 time studies of underground loading and haulage—is contained in a free bulletin which we will gladly send you on request. It contains many facts that mean dollars and cents to you.

For instance—battery cars produce 22% more tons per shuttle car hour . . . they travel 25% faster and discharge 30% faster . . . they produce more tons per man shift and at lower haulage cost per ton in shuttle car sections.

If the interest of more profitable operation, send for "A Report of Mine Shuttle Car Operation Based on 23 Published Time Studies." Address Dept. M-50.

Battery-powered shuttle cars have the following advantages demonstrated and proved:

SAFETY
Only battery cars are "permissible"

PRODUCTION
Can produce 10% more tonnage
Deliver more tons per man shift
Give 22% more ton-miles per shuttle car hour
Are more dependable and predictable
Handle supplies easier
Reduce shuttle car change time
Can gob underground
Promote section efficiency

PERFORMANCE
Include all design advances
Travel 25% faster
Discharge 30% faster

COST
Equal capital cost
Produce coal in shuttle car sections for approximately ½c less per ton —in hand-loaded sections, as much as 75c a ton

A "MUST" FOR CONTINUOUS MINING MACHINES

Battery-powered shuttle cars enable continuous mining machines to work 10% more of the shift.

AND . . .

Two-shift operation is now possible with only one set of batteries.

GOULD
STORAGE BATTERY CORPORATION
TRENTON 5, NEW JERSEY

Always Use Gould Automobile and Truck Batteries

● One of many Republic Conveyor Belts now helping users pile up bigger profits is the 24-inch Record Maker pictured above.

For nearly three years, this Republic Belt has been in constant use at the Coon Valley Sand & Gravel Company in Des Moines, Iowa.

It's a standard type belt fitted to the job by an experienced Republic Distributor, the Globe Machinery & Supply Company, and, although continually exposed to extreme and varying weather conditions, it has handled hundreds of tons of abrasive aggregates. Today, the same belt is hard at work . . . still going strong.

If, like thousands of conveyor belt users, you want custom-built features which give you results like this, without incurring special fabricating charges, check with Republic. Your local Republic Distributor carries in stock hundreds of job-designed industrial rubber goods items, like Record Maker Belting. He can give you immediate and expert service in every field of application.

Remember, Republic has been *the* specialist in development and manufacture of industrial rubber goods for more than 48 years!

Mr. C. W. Helstrom, Vice-President, Manager Globe Machinery & Supply Company Des Moines, Iowa

Pioneers in the use of COLD RUBBER

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN, OHIO
Lee Deluxe Tires & Tubes - - - Conshohocken, Pa.

MECHANICAL RUBBER GOODS BY
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The Proof of Quality Is in PERFORMANCE

For over half a century, "HERCULES" (Red-Strand) Wire Rope has been proving its outstanding quality by the accurate yardstick of performance—on all sorts of jobs, and in one industry after another. Such *consistent* performance is not a matter of chance. Design . . . rigid tests and inspections . . . equipment . . . firm standards — are essential factors.

As "HERCULES" is made in a wide range of sizes, types and constructions—Preformed or Non-Preformed—there is in this one grade, a "right rope" for *any* heavy duty purpose.

We Invite Your Inquiries

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WET OR DRY GRINDING
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OPEN OR CLOSED CIRCUIT
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ALSO AIR SWEPT FOR GRINDING AND DRYING
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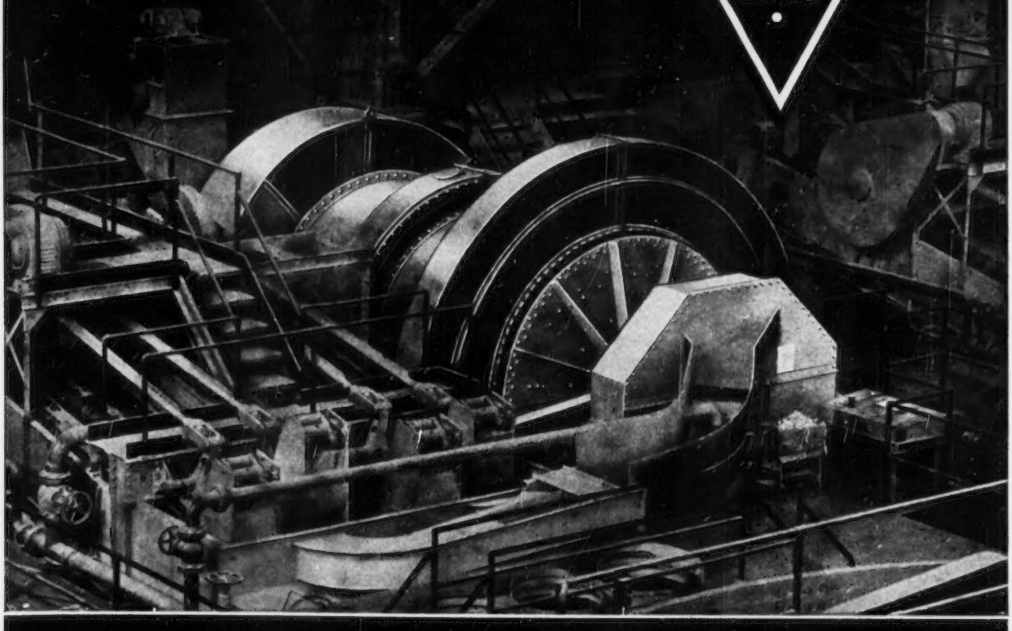


F. L. SMIDTH & CO.

11 WEST 42ND STREET

ENGINEERS
MANUFACTURERS OF BALLMILLS
SINCE 1895

NEW YORK, N. Y.

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT Calol Multi-Service Oils

UNIT Compressor cylinders - 30"x20" parallel

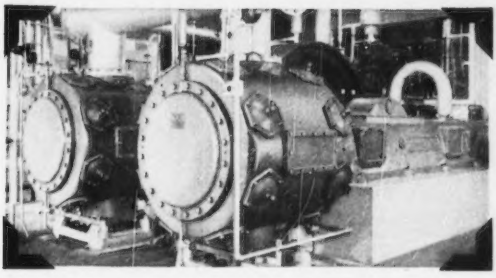
LUBRICATOR Force-feed

CONDITIONS Furnishes furnace stack draft and compresses flue gas — high chemical content

PERIOD 2 years

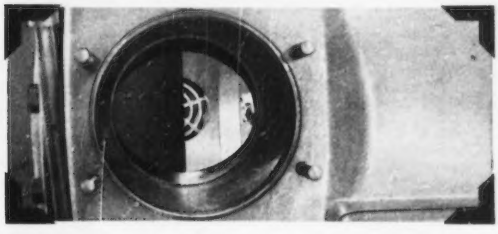
FIRM Pure Carbonic Co., Berkeley, Calif. (A Division of Air Reduction Co., Inc.)

Special oil cuts wear in compressor handling corrosive gas



CALOL MULTI-SERVICE OIL 55X held wear down in these thirty-inch compressor cylinders to an average of only 0.0015 inch in two years, although they handle only raw flue gas. This is part of Pure Carbonic Company's process for producing CO_2 to make "Dry Ice."

OXYGEN, NITROGEN, SULPHUR and carbon dioxide are some of the chemicals in the millions of cubic feet of flue gas from furnace stacks that go through the compressor in a day. A valve has been removed showing where deposits from corrosive elements may accumulate.

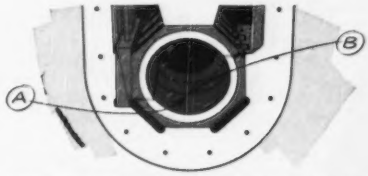


PORTION OF A CYLINDER, seen through a valve port, shows how CALOL Multi-Service Oil 55X keeps walls clean and lubricated. It withstands the highest operating temperatures, keeps a uniform lubricating film on all surfaces and is especially resistant to lacquer formation.

REMARKS: The compressor pictured here is an Ingersoll-Rand Type XPL. (30X20" Compressor Cylinders; 13x20" Steam.) The gas it handles in 24 hours produces 120,000 pounds of liquid carbon dioxide. CALOL Multi-Service Oil 55X lubricates the journals and crankpins as well as cylinders. There are grades of CALOL Multi-Service Oil to meet conditions in all types of compressors.

Trademark "CALOL" Reg. U. S. Pat. Off.

How CALOL Multi-Service Oil cuts costs in all types of compressors



In crankcase and on cylinders, CALOL Multi-Service Oil reduces oil consumption -- has cut consumption 20% in air compressors.

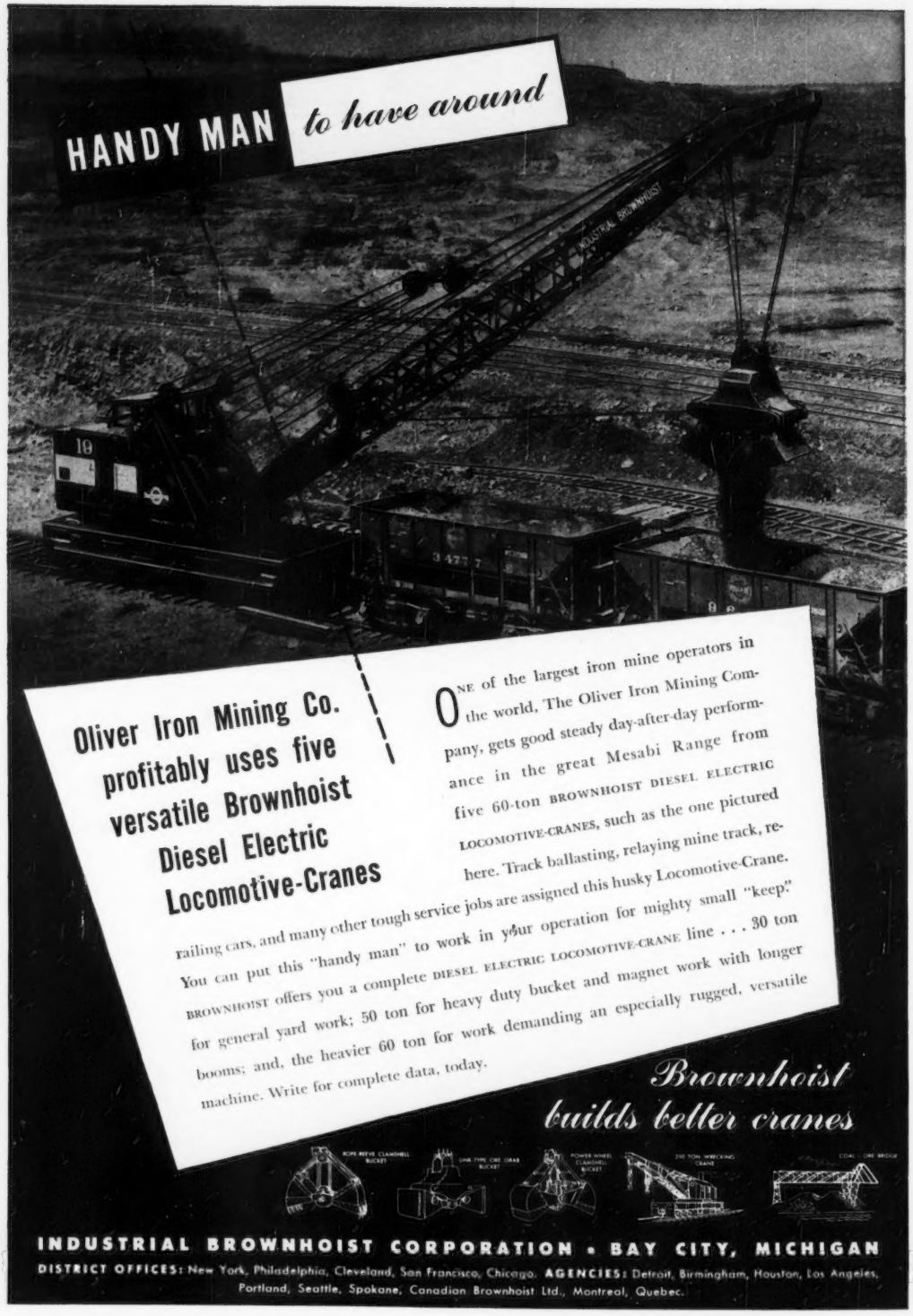
A. Oxidation-resistant compounds prevent formation of varnish. Detergent keeps contaminants suspended in oil, prevents foam.

B. Special compound assures "hot-spot" lubrication ... covers surfaces rapidly.

CALOL Multi-Service Oils also recommended for pumps, diesel engines, enclosed gears.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco
THE CALIFORNIA OIL COMPANY • Barber, N.J., Chicago, New Orleans
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA COMPANY • Denver, Colorado



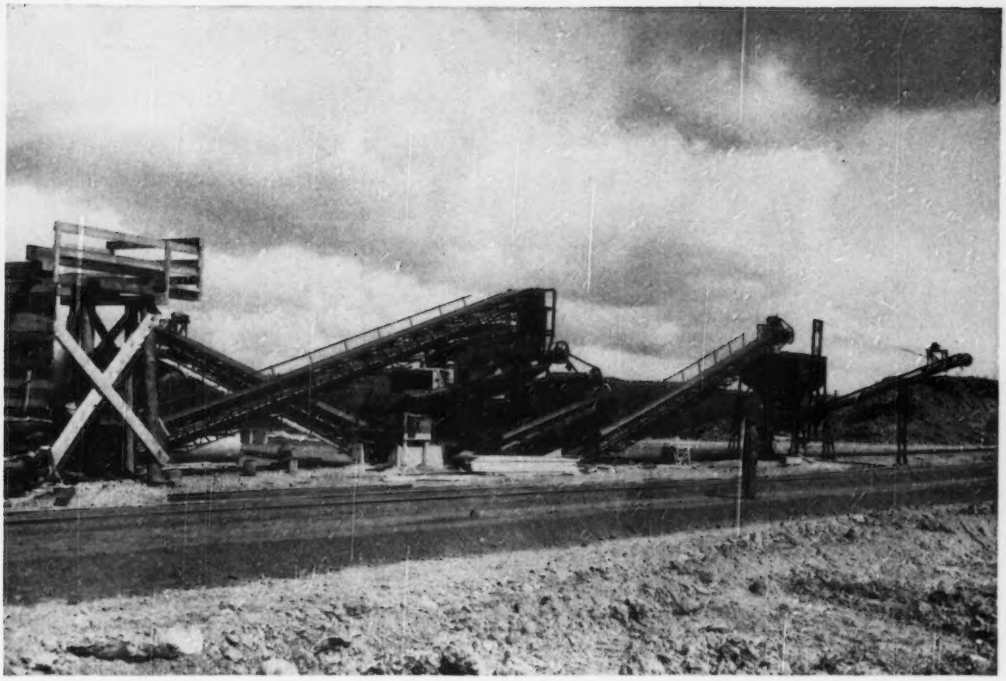
Oliver Iron Mining Co. profitably uses five versatile Brownhoist Diesel Electric Locomotive-Cranes

One of the largest iron mine operators in the world, The Oliver Iron Mining Company, gets good steady day-after-day performance in the great Mesabi Range from five 60-ton BROWNHOIST DIESEL ELECTRIC LOCOMOTIVE-CRANES, such as the one pictured here. Track ballasting, relaying mine track, re-railing cars, and many other tough service jobs are assigned this husky Locomotive-Crane. You can put this "handy man" to work in your operation for mighty small "keep." BROWNHOIST offers you a complete DIESEL ELECTRIC LOCOMOTIVE-CRANE line . . . 30 ton for general yard work; 50 ton for heavy duty bucket and magnet work with longer booms; and, the heavier 60 ton for work demanding an especially rugged, versatile machine. Write for complete data, today.

Brownhoist builds better cranes

INDUSTRIAL BROWNHOIST CORPORATION • BAY CITY, MICHIGAN

DISTRICT OFFICES: New York, Philadelphia, Cleveland, San Francisco, Chicago. AGENCIES: Detroit, Birmingham, Houston, Los Angeles, Portland, Seattle, Spokane, Canadian Brownhoist Ltd., Montreal, Quebec.



Concentrate...100 tons an hour!

One of the most efficient ore washing plants on the Mesabi Range was recently set up by the Hedman Mining Company. It is located near Buhl, Minnesota. Production has averaged 90 to 100 tons of concentrate an hour . . . recovery 65% to 70% of input. Here's how it operates:

Ore is trucked to washing plant and dumped into a receiving hopper located over a Pioneer 30″ Reciprocating Plate Rock Feeder. A Pioneer 30″ Conveyor receives the material from feeder discharging it on the Pioneer Triple Deck Screen (5′x12′).

Screening. The 4″ oversize from the top deck of the screen is carried to a Pioneer 10 yard Rock Bin by another Pioneer 24″ Conveyor.

Screened material from the middle and bottom decks converges and is carried to a Pioneer Surge Bin by Pioneer Belt Conveyors.

Fines passing the bottom deck pass through a Twin Screw Classifier. These also go to the Surge Bin. A Pioneer 18″ Conveyor loads ore cars direct from Surge Bin.

Power. The main plant and feeder conveyor are driven by V-belt direct from a diesel unit. This same diesel also drives a 25KW generator which supplies power for electric motors on three other conveyors. A second diesel unit powers a pump which furnishes water for the classifier.

In addition to Conveyors, Screens, Bins and Feeders, Pioneer has designed other tough, rugged equipment for the mines. Huge Pioneer Jaw and Roll Crushers, the Pioneer-Oro Manganese Steel Apron Feeder, Mesabi Heavy-Duty Conveyors are building unsurpassed records for high production and minimum maintenance.

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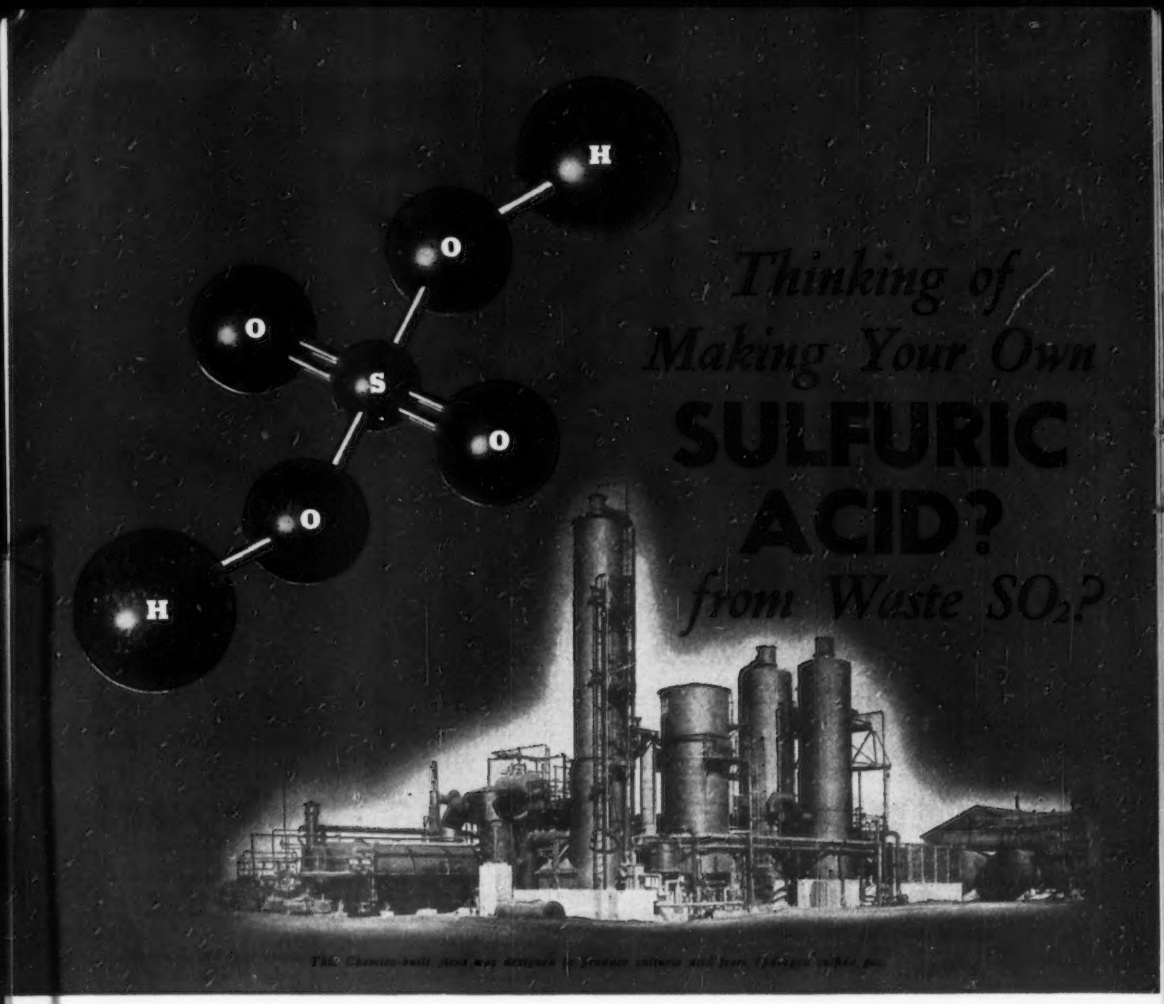

Many users find it economical to buy sulfuric acid in drums or in tank cars. Others—who need larger quantities—produce their own more profitably. If you have been contemplating the expansion of your present facilities or the erection of a new plant for the manufacture of sulfuric acid, consider these facts about Chemico-built contact acid plants.

TROUBLE FREE OPERATION—You get maximum production of acid the year round because of Chemico's proved designs for waste gas plants.

HIGH CONVERSION—The high production rate and low operating costs of Chemico plants are largely due to the well designed converters and the use of the highly effective, non-poisonable Vanadium Catalyst.

These cost-reduciing design features are only a few of the outstanding benefits of Chemico-built sulfuric acid plants. They may point the way to vital savings in fulfilling your acid needs. But before deciding whether it would be sound business to produce your own sulfuric acid, discuss your specific problems with Chemico.

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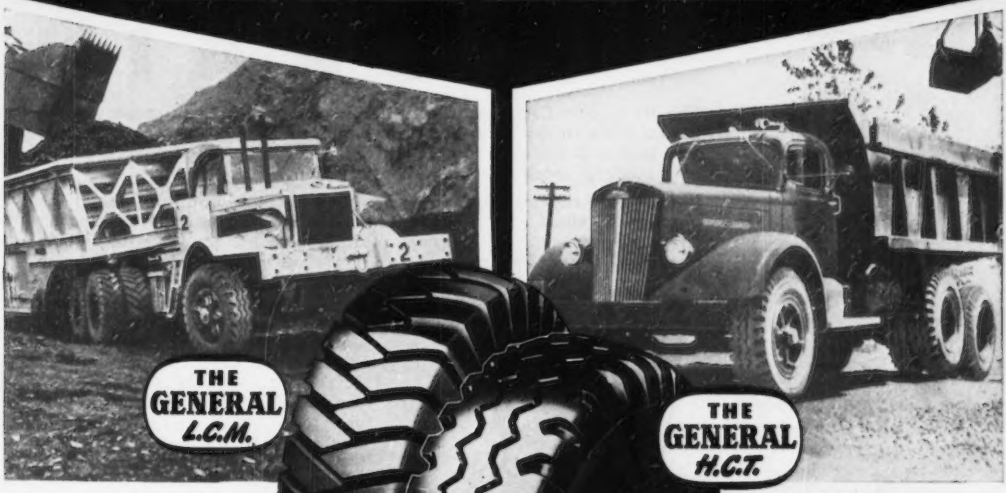


For most work off the road

GENERAL L. C. M.—thick, tough, deep lugs resist cuts, bruises. Tremendous self-cleaning tread develops extra traction forward or backward.

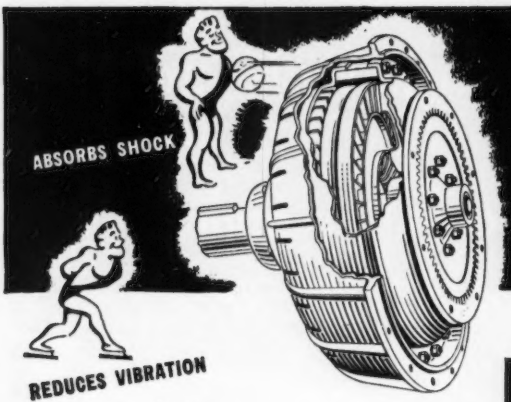
For most work on the road

GENERAL H. C. T.—tough, broad tread wears longer, has more traction. Free-rolling tread ribs steer easier, stop quicker on the highway.

GENERAL UNDERGROUND MINING TIRE—wide, deep-lug tread develops extra traction forward or backward. Reinforced side walls resist cuts, scrapes and bruises. Thick, diagonal tread bars steer easier, grip faster, give more hours of productive work.

THE GENERAL TRUCK TIRE

SPECIFY GENERAL TIRES ON YOUR NEW EQUIPMENT



No Stall . . No Shock . . IN THE ROUGHEST ROCK

With a FLUID DRIVE

LORAIN

The Hydraulic Coupling (fluid clutch) is standard equipment on big Lorain-820's in the 2 yd. class. No single feature will pay more profits . . . and add more in production and long life service . . . than this rock-busting, shock-absorbing Lorain drive.

It increases shovel output by improving engine "hang-on" when the digging is tough . . . It prevents engine stalling under *any* digging circumstances . . . It reduces maintenance by acting as a "shock-absorber" so that shocks and stresses are not transferred into turntable mechanism and cables . . . It reduces vibration . . . It's the one big feature you need for rock! Get the Lorain-820 . . . and you've got the best answer to every digging condition . . . from the softest sand to the hardest rock. Want to see one work? Ask your Thew-Lorain Distributor to take you where there's action!

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LORAIN 820's
Beat Them All On Rock

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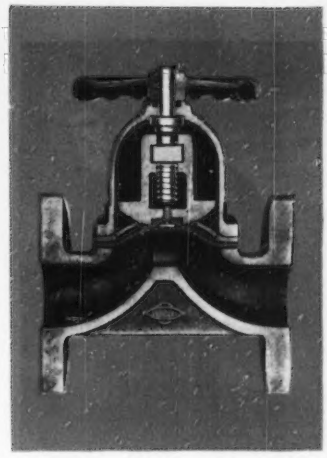
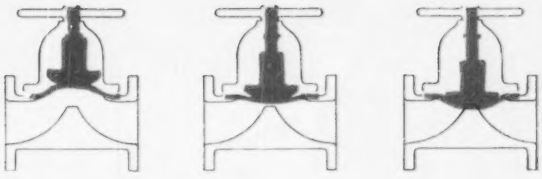
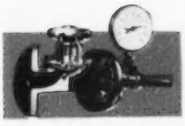


If you need a diaphragm valve you need all the advantages of diaphragm closing



Check these popular features of

GRINNELL-SAUNDERS DIAPHRAGM VALVES



Diaphragm gives leak-tight closure against grit, scale, solid matter . . . Even when something as substantial as an 8-penny nail is trapped on the weir of a rubber lined valve, as illustrated, the resilient diaphragm, plus the large area of contact, gives leak-tight closure against pressure or vacuum.

Diaphragm lifts high for streamlined flow in either direction . . . Smooth, streamlined passage, without pockets, prevents trapping of sludge and reduces frictional resistance to a minimum—irrespective of direction of fluid flow. No disc holder in fluid stream. Grinnell-Saunders Diaphragm Valves are self-draining when installed with the spindle at 15 degrees above the horizontal position.

Diaphragm absolutely isolates working parts from fluid . . . There's no "if" about the way a continuous, one-piece diaphragm seals off the working parts from fluids; no perforation or puncture in the diaphragm where fluid or gas can possibly leak by the valve spindle. No sticking, clogging or corroding of working parts. Valve lubricant cannot contaminate the fluid in the line.

Diaphragm, body and lining materials to meet particular conditions . . . Bodies stocked in cast iron, malleable iron, stainless steel, bronze and aluminum: other materials on special orders. Valve bodies lined with lead, glass, natural rubber or neoprene. Diaphragm materials of natural rubber or synthetics. Working pressure, 150 lbs.; maximum temperature, 180°F.

Diaphragm is only part that normally wears and needs replacement . . . Depending on the type of service, it may last for years, particularly since the compressor and finger plate combine to support the diaphragm in all positions. The diaphragm can be replaced quickly without removing valve from line. No refacing or reseating. No disc holder to require tightening or replacing. No packing glands to demand attention.

Write today for the new Grinnell-Saunders Diaphragm Valve Catalog 4-S.

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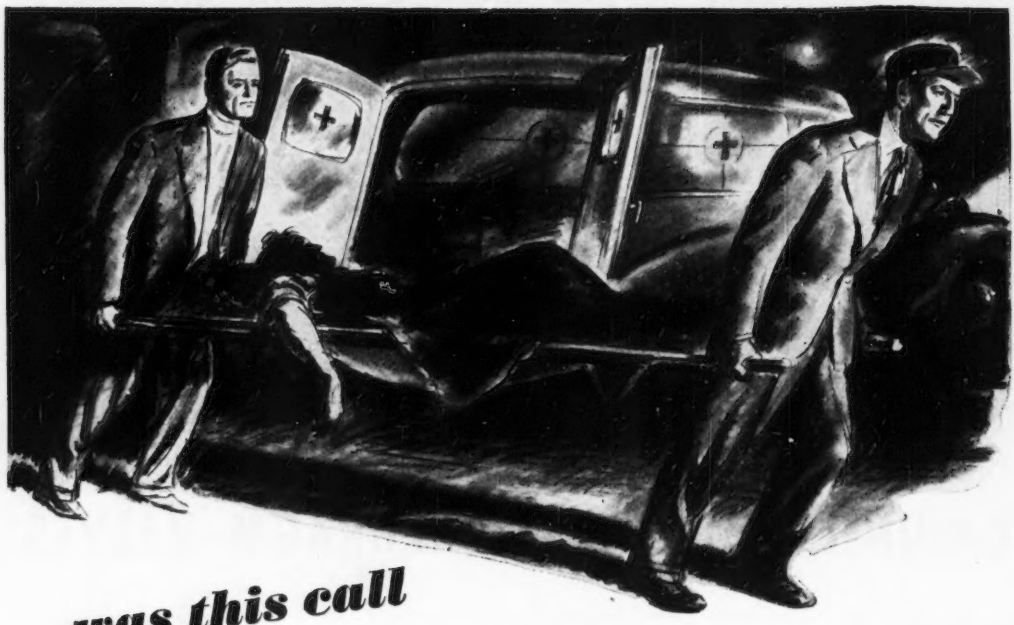

was this call necessary?

Some "Moral Insurance" here might have avoided a serious accident

Workmen's compensation is a fine thing—but it can't replace a mangled arm.

Safety laws prevent many accidents—but they can't cover every hazard of an individual plant.

Accident prevention which goes *beyond the law* is an unwritten responsibility of every employer. It is his "Moral Insurance" for his employees welfare.

The premiums for "Moral Insurance" are not high. They do not have to be paid for in fancy safety gadgets. Their cost is simply the institution of common sense safety regulations covering all local hazards—enforced by employee committees with the full support of management.

Yes—"plant safety" is a mutual job.

DON'T FORGET—THE LIFE YOU SAVE MAY BE YOUR OWN

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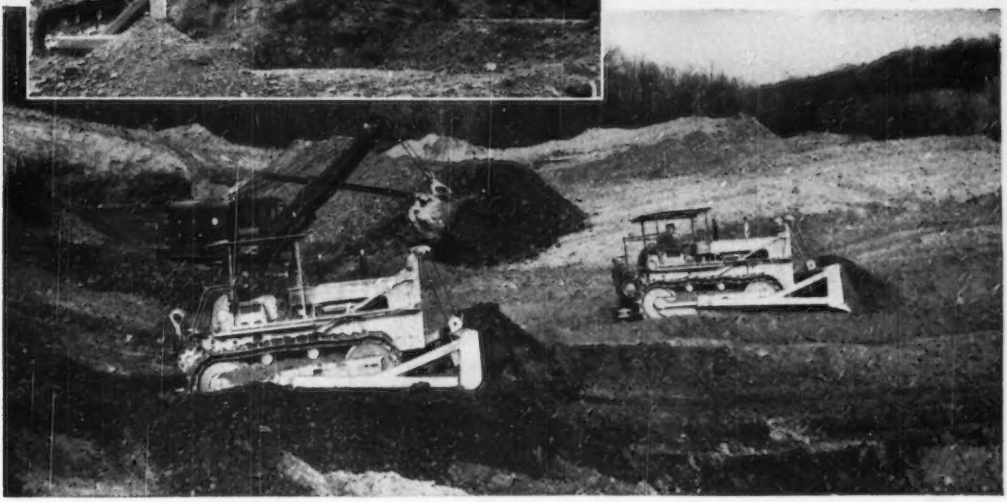
—Bob Rardin, Canton, Ohio.



Owner Bob Rardin tells this tale of TD-24 performance on his strip mining job near Canton, Ohio.

"It's easy to keep ahead of the loading shovel. With 35 feet of overburden to shove 75 yards, we can even gain a little. The TD-24's work right along on slopes so steep that we have to cut them down before other tractors can even navigate them unloaded. They are fast tractors, easy to shift, and they have plenty of 'steam'. This combination really moves dirt."

No wonder everybody calls the TD-24 the "Champion of Crawlers." No other crawler can come close to TD-24 performance on the job.

Mr. Rardin says, "All the Internationals we have owned have made us more money than any other tractors could. Service has always been good and parts delivered promptly when needed."

Why wait and wonder what the TD-24 can do for you? See it and try it yourself. Visit your International Industrial Power Distributor—the first step toward getting the "Champion of Crawlers" to work for you.

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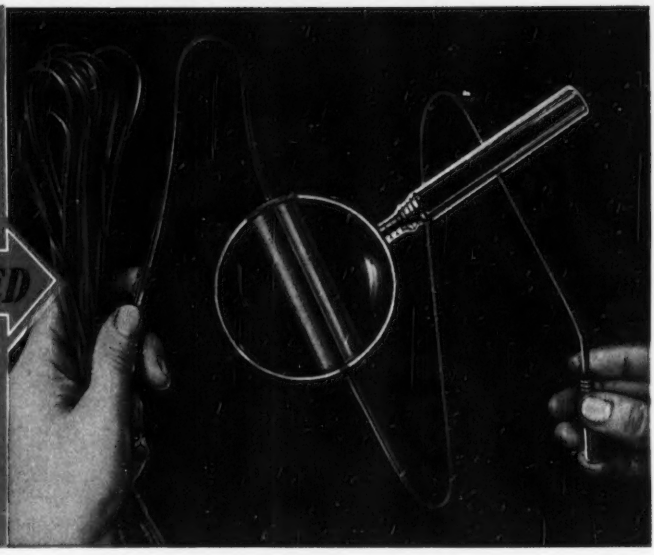

Designed for roughest field conditions... to meet the most exacting demands of blasters

Hundreds of good plastic insulating compounds were tried and rejected by Atlas Research before the new Atlas plastic-covered wire was developed. Our wire had to measure up to the most rigid demands of men who use electric blasting caps under every conceivable condition.

If you're one of our many customers who have already tried the new Atlas plastic-covered leg wires or connecting wire, you'll agree that this wire comes up to the highest expectations—and more! Here's why:

1. *It's really tough — and truly waterproof!* Thick plastic covering, made to withstand rough handling in jagged bore holes. Fully waterproof. Extremely high insulating value.
2. *Less kinking and snarling!* With minimum care, it folds or reels out without tangles or kinks—saves time and tempers in hooking up.
3. *Flexible at 20° below zero!* Made to withstand Arctic or Tropic weather.
4. *Easy on eyes and hands!* No eye-strain to see the brilliant orange or yellow wire, even in dull light. No rough edges when duplex wire is separated into single strands.
5. *Stands up to rigid tests!* Compare it with other wire for these outstanding properties; and also for high tensile and compression strength; resistance to deterioration from weather, rodents, vermin.

Now available in duplex on all Atlas Manasite electric blasting caps with wires 30 feet long or more. Two single plastic-covered wires on shorter lengths.

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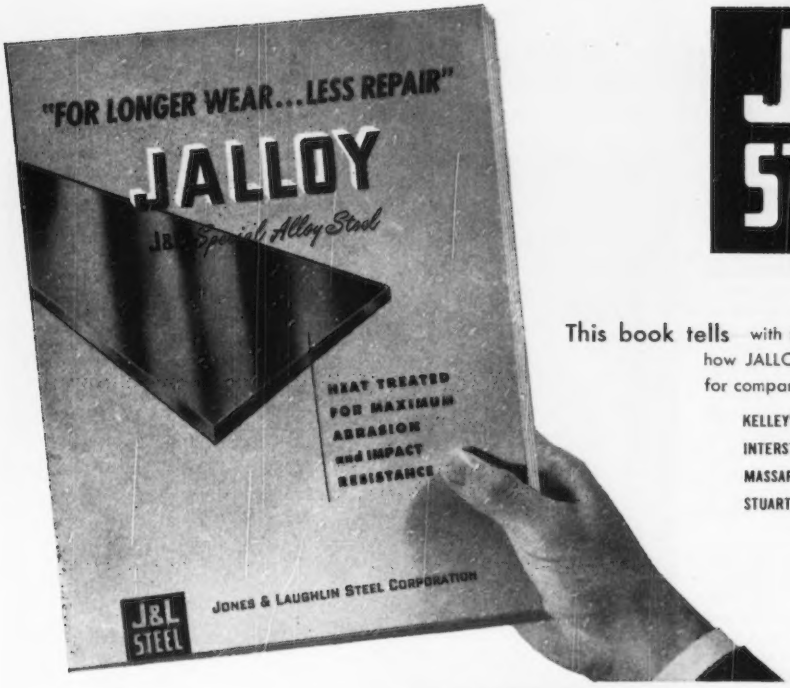
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America finds a new, easy way to save

Out of the war has come one blessing—a lesson in thrift for millions of those who never before had learned to save.

Enrolled under the Payroll Savings Plan in thousands of factories, offices, and stores, over 27 million American wage earners were purchasing "E" Bonds alone at the rate of about 6 billion dollars worth a year by the time V-J Day arrived.

With War Bond Savings automatically deducted from their wages every week, thrift was "painless" to these wage earners. At the end of the war, many who never before had bank accounts could scarcely believe the savings they held.

The moral was plain to most. Here was a new, easy way to save; one as well suited to the future as to the past. Result: Today, millions of Americans are continuing to buy, through their Payroll Savings Plan, not War Bonds, but their peacetime equivalent—*U. S. Savings Bonds.*

From war to peace! War Bonds are now known as U. S. Savings Bonds, bring the same high return—$25 for every $18.75 at maturity.

Out of pay—into nest eggs! A wage earner can choose his own figure, have it deducted regularly from earnings under Payroll Savings Plan.

New homes to own! Thousands of new homes, like this, will be partially paid for through Bonds wisely accumulated during the next five to ten years.

Keeping cost of living in check! Buying only needed plentiful goods and saving the money which would bid up prices of scarce goods keeps your cost of living from rising. Save *automatically—regularly.*

Weekly Savings	SAVINGS AND INTEREST ACCUMULATED In 1 Year	In 10 Years
$ 3.75	$195.00	$2,163.45
6.25	325.00	3,607.54
7.50	390.00	4,329.02
9.38	487.76	5,416.97
12.50	650.00	7,217.20
15.00	780.00	8,660.42
18.75	975.00	10,828.74

Savings chart. Plan above shows how even modest weekly savings can grow into big figures. Moral: Join your Payroll Savings Plan next payday.

SAVE THE EASY WAY...

BUY YOUR BONDS

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1 Latest advanced design and construction for maximum production.

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5 All joints accurately machined and doweled for quick assembly in the field.

6 No side movement or shifting of jaw plates (no zincing is required).

7 New arrangement of jaw plate toe lugs permits 50% more wear off plates before they must be replaced.

8 Completely automatic lubrication to all parts of crusher cuts your power and maintenance costs.

9 New, longer swing jaw brings you faster crushing to smaller sizes.

10 Newly designed toggles have renewable flame hardened ends. Can be quickly and cheaply replaced. Eliminates cost of new toggles to correct end wear.

11 Special pitman cuts upkeep and repairs 50%. New design holds weight down to minimum without sacrificing strength.

12 Removable water-jacketed cap, adjustable for wear, allows quick rebabbitting.

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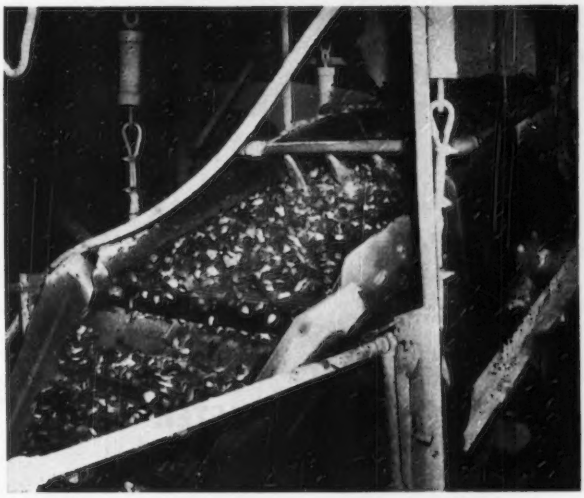

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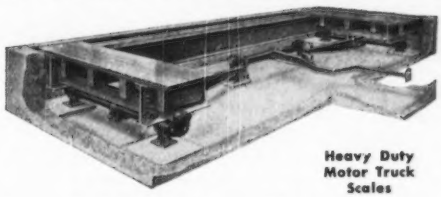

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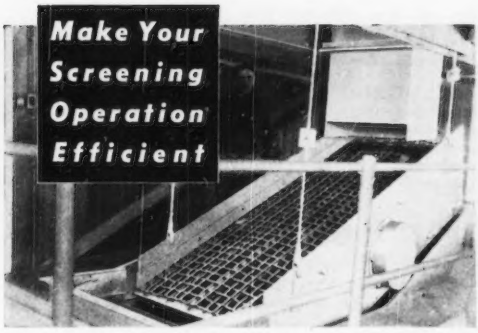

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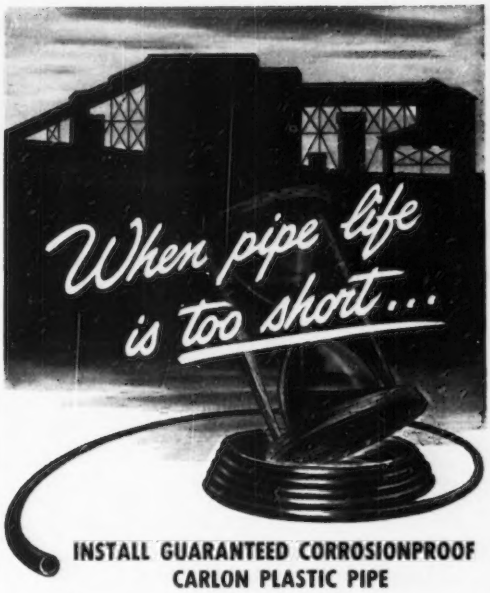

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3/4"	1.050	0.824	350 lb.	0.140 lb.	400 ft. coils
1"	1.310	1.070	200 lb.	0.181 lb.	300 ft. coils
1 1/4"	1.660	1.380	200 lb.	0.267 lb.	300 ft. coils
1 1/2"	1.900	1.610	200 lb.	0.320 lb.	250 ft. coils
2"	2.378	2.070	170 lb.	0.445 lb.	200 ft. coils
3"	3.504	3.070	165 lb.	0.91 lb.	100 ft. coils
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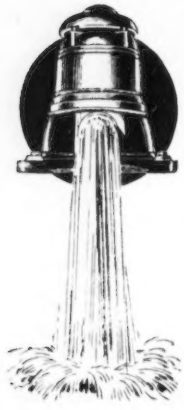

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10"	4	1/16"	1/32"	28 Oz.
12"	4	1/16"	1/32"	28 Oz.
14"	4	1/16"	1/32"	28 Oz.
16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
36"	6	1/8"	1/16"	32 Oz.
42"	5	1/8"	1/16"	32 Oz.
48"	8	1/8"	1/16"	32 Oz.

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1—GD-9 Gardner-Denver rocker shovel loader.
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5—Wilfley #6, left hand.
12—Deister "Flat-O," right hand.
43—Diester "Flat-O," left hand.

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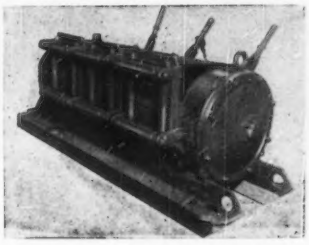

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1—8" x 12" Universal Semi-Steel Crusher.
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1—9" x 16" New Morse Crusher.
1—9" x 21" Telsmith Jaw Crushers.
1—8" x 36" Universal All-Steel Crusher.
1—9" x 36" Cedar Rapids.
1—15" x 20" Universal All-Steel Crusher.
1—10" x 24" Allis-Chalmers Jaw Crusher.
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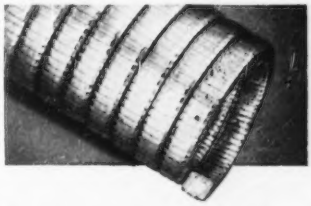

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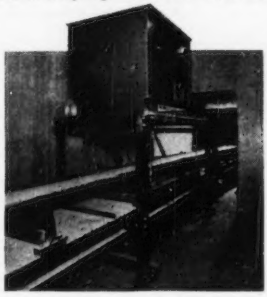

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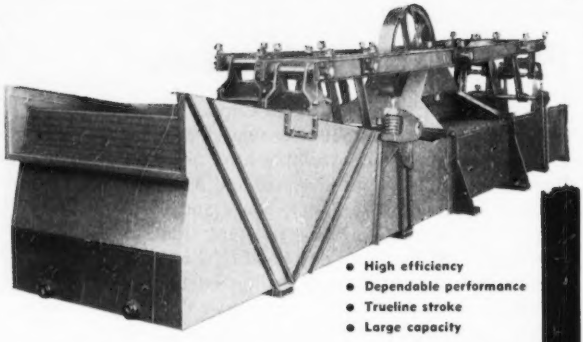

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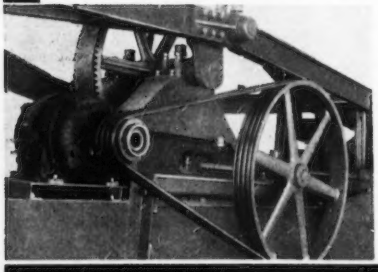

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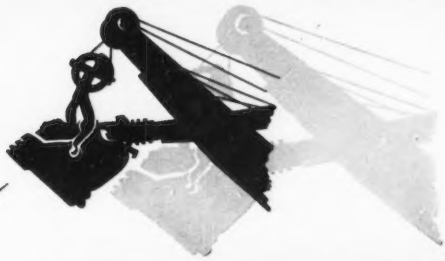

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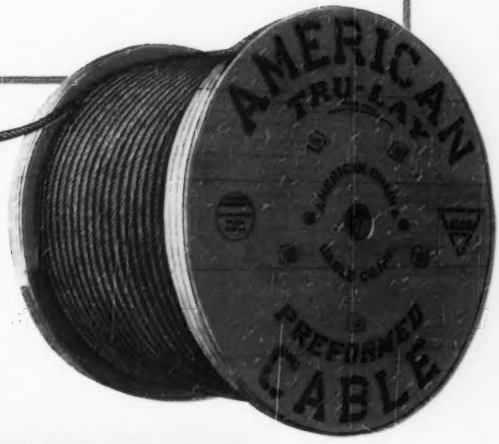

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